2005 Tri-Service Infrastructure Systems Conference & Exhibition

St. Louis, MO
"Re-Energizing Engineering Excellence"

2-4 August 2005

Agenda

***Panel**: The Future of Engineering and Construction*

- LTG Carl A. Strock, Commander, USACE
- Dr. James Wright, Chief Engineer, NAVFAC

***Panel**: USACE Engineering and Construction*

- Dr. Michael J. O'Connor, Director, R&D

***Panel**: Navy General Session*

- Mr. Steve Geusic, Engineering Criteria & Programs NAVFAC Atlantic

Introduction to Multi-Disciplinary Tracks, by Mr. Gregory W. Hughes
Engineering Circular: Engineering Reliability Guidance for Existing USACE Civil Works Infrastructure, by Mr. David M. Schaaf, PE, LRD Regional Technical Specialist, Navigation Engineering Louisville District
MILCON S&A Account Study, by Mr. J. Joseph Tyler, PE, Chief, Programs Integration Division, Directorate of Military Programs HQUSACE
Financial Justification on Bentley Enterprise License Agreement (ELA)

Track 1

- The Chicago Shoreline Storm Damage Reduction Project, by Andrew Benziger
- Protecting the NJ Coast Using Large Stone Seawalls, by Cameron Chasten
- Cascade: An Integrated Coastal Regional Model for Decision Support and Engineering Design, by Nicholas C. Kraus and Kenneth J. Connell
- Modeling Sediment Transport Along the Upper Texas Coast, by David B. King Jr., Jeffery P. Waters and William R. Curtis
- Sediment Compatibility for Beach Nourishment in North Carolina, by Gregory L. Williams
- Evaluating Beachfill Project Performance in the USACE Philadelphia District, by Monica Chasten and Harry Friebel
- US Army Corps of Engineers' National Coastal Mapping Program, by Jennifer Wozencraft
- Flood Damage Reduction Project Using Structural and Non-Structural Measures, by Stacey Underwood
- Shore Protection Project Performance Improvement Initiative (S3P2I), by Susan Durden
- Hurricane Isabel Post-Storm Assessment, by Jane Jablonski
- US Army Corps of Engineers Response to the Hurricanes of 2004, by Rick McMillen and Daniel R. Haubner
- Increased Bed Erosion Due to Increased Bed Erosion Due to Ice, by Decker B. Hains, John I. Remus, and Leonard J. Zabilansky
- Mississippi Valley Division, by James D. Gutshall
- Impacts to Ice Regime Resulting from Removal of Milltown Dam, Clark Fork River, Montana, by Andrew M. Tuthill and Kathleen D. White, and Lynn A. Daniels
- Carroll Island Micromodel Study: River Miles 273.0-263.0, by Jasen Brown
- Monitoring the Effects of Sedimentation from Mount St. Helens, by Alan Donner, Patrick O'Brien and David Biedenharn
  Watershed Approach to Stream Stability and Benefits Related to the Reduction of Nutrients, by John B. Smith
- A Lake Tap for Water Temperature Control Tower Construction at Cougar Dam, Oregon, by Stephen Schlenker, Nathan Higa and Brad Bird
- San Francisco Bay Mercury TMDL – Implications for Constructed Wetlands, by Herbert Fredrickson, Elly Best and Dave Soballe
- Abandoned Mine Lands: Eastern and Western Perspectives, by Kate White and Kim Mulhern
  Translating the Hydrologic Tower of Babel, byDan Crawford
- Demonstrating Innovative River Restoration Technologies: Truckee River, Nevada, by Chris Dunn
- System-Wide Water Resource Management – Tools of the Trade

Track 2

- Ecological and Engineering Considerations for Dam Decommissioning, Retrofits, and Reoperations, by Jock Conyngham
- Hydraulic Design of tidegates and other Water Control structures for Ecosystem Restoration projects on the Columbia River estuary, by Patrick S. O'Brien
- Surface Bypass & Removable Spillway Weirs, by Lynn Reese
- Impacts of using a spillway for juvenile fish passage on typical design criteria, by Bob Buchholz
- Howard Hanson Dam: Hydraulic Design of Juvenile Fish Passage Facility in Reservoir with Wide Pool Fluctuation, by Dennis Mekkers and Daniel M. Katz
- Current Research in Fate Current Research in Fate & Transport of Chemical and Biological Contaminants in Water Distribution Systems, by Vincent F. Hock
- Regional Modeling Requirements, by Maged Hussein
- Tools for Wetlands Permit Evaluation: Modeling Groundwater and Surface Water Interaction, by Cary Talbot
- Ecosystem Restoration for Fish and Wildlife Habitat on the UMRS, by Jon Hendrickson
- Missouri River Shallow Water Habitat Creation, by Dan Pridal
- Aquatic Habitat Restoration in the Lower Missouri River, by Chance Bitner
- Transition to an Oracle Based Data System (Corps Water Management System, CWMS), by Joel Asunskis
- RiverGages.com: The Mississippi Valley Division Water Control Website, by Rich Engstrom
- HEC-ResSim 3.0: Enhancements and New Capabilities, by Fauwaz Hanbali
- Hurricane Season 2004 – Not to Be Forgotten, by Jacob Davis
- Re-Evaluation of a Flood Control Project, by Ferris W. Chamberlin
- Helmand Valley Water Management Plan, by Jason Needham
- A New Approach to Water Management Decision Making, by James D. Barton
- Developing Reservoir Operational Plans to Manage Erosion and Sedimentation during Construction – Willamette Temperature
- Control, Cougar Reservoir 2002-2005, by Patrick S. O'Brien
- Improved Water Supply Forecasts for the Kootenay Basin, by Randal T. Wortman
- ResSIM Model Development for Columbia River System, by Arun Mylvahanan
- Prescriptive Reservoir Modeling and the ROPE, by Jason Needham
- Missouri River Basin Water Management, by Larry Murphy

Track 3

- Corps Involvement in FEMA's Map Modernization Program, by Kate White, John Hunter and Mark Flick
- Innovative Approximate Study Method for FEMA Map Moderniation Program , by John Hunter
- Flood Fighting Structures Demonstration and Evaluation Program (FFSD), by Fred Pinkard
- Integrating Climate Dynamics Into Water Resources Planning and Management, by Kate White
- Hydrologic and Hydraulic Contributions to Risk and Uncertainty Propagation Studies, by Robert Moyer
- Uncertainty Analysis: Parameter Estimation, by Jackie P. Hallberg
- Geomorphology Study of the Middle Mississippi River, by Eddie Brauer
- Bank Erosion and Morphology of the Kaskaskia River, by Michael T. Rodgers
- Degradation of the Kansas City Reach of the Missouri River, by Alan Tool
- Sediment Impact Assessment Model (SIAM), by David S. Biedenharn and Meg Jonas
- Mississippi River Sedimentation Study, by Basil Arthur
- Sediment Model of Rivers, by Charlie Berger
- East Grand Forks, MN and Grand Forks, ND Local Flood Damage Reduction Project, by Michael Lesher
- Hydrologic and Hydraulic Analyses, by Thomas R. Brown
- Hydrologic and Hydraulic Modeling of the Mccook and Thornton Tunnel and Reservoir Plans, by David Kiel
- Ala Wai Canal Project, by Lynnette F. Schaper
- Missouri River Geospatial Decision Support Framework, by Bryan Baker and Martha Bullock
- Systemic Analysis of the Mississippi & Illinois Rivers Upper Mississippi River Comprehensive Plan, by Dennis L. Stephens

Section 227: National Shoreline Erosion Control Demonstration and Development Program Annual Workshop

- Workshop Objectives
- Section 227: Oil Piers, Ventura County, CA, by Heather Schlosser
- An Evaluation of Performance Measures for Prefabricated Submerged Concrete Breakwaters: Section 227 Cape May Point, New Jersey Demonstration Project, by Donald K Stauble, J.B. Smith and Randall A. Wise
- Bluff Stabilization along Lake Michigan, using Active and Passive Dewatering Techniques, by Rennie Kaunda, Eileen Glynn, Ron Chase, Alan Kehew, Amanda Brotz and Jim Selegean
- Storm Damage at Cape Lookout
- Branchbox Breakwater Design at Pickleweed Trail, Martinez, CA
- Section 227: Miami, FL
- Section 227: Sheldon Marsh Nature Preserve
- Section 227: Seabrook, New Hampshire
- Jefferson County, TX – Low Volume Beach Fill
- Sacred Falls, Oahsacred Falls, Oahu Section 227 Demonstration Project

Track 4

- Fern Ridge LakFern Ridge Lake Hydrologic Aspects of Operation during Failure, by Bruce J Duffe
- A Dam Safety Study Involving Cascading Dam Failures, by Gordon Lance
- Spillway Adequacy Analysis of Rough River Lake Louisville District, by Richard Pruitt
- Water Management in Iraq: Capability and Marsh Restoration, by Fauwaz Hanbali
- Iraq Ministry of Water Resources Capacity Building, by Michael J. Bishop, John W. Hunter, Jeffrey D. Jorgeson, Matthew M. McPherson, Edwin A. Theriot, Jerry W. Webb, Kathleen D. White, and Steven C. Wilhelms

- HEC Support of the CMEP Program, by Mark Jensen
- Geospatial Integration of Hydrology & Hydraulics Tools for Multi-Purpose, Multi-Agency Decision Support, by Timothy Pangburn, Joel Schlagel, Martha Bullock, Michael Smith, and Bryan Baker
- GIS & Surveying to Support FEMA Map Modernization and Example Bridge Report, by Mark Flick
- High Resolution Bathymetry and Fly-Through Visualization, by Paul Clouse
- Using GIS and HEC-RAS for Flood Emergency Plans, by Stephen Stello
- High Resolution Visualizations of Multibeam Data of the Lower Mississippi River, by Tom Tobin and Heath Jones
- System Wide Water Resources Program Unifying Technologies Geospatial Applications, by Andrew J. Bruzewicz
- Raystown Plate Locations
- Hydrologic Engineering Center: HEC–HMS Version 3.0 New Features, by Jeff Harris
- SEEP2D & GMS: Simple Tools for Solving a Variety of Seepage Problems, by Clarissa Hansen, Fred Tracy, Eileen Glynn, Cary Talbot and Earl Edris
- Sediment and Water Quality in HEC-RAS, by Mark Jensen
- Advances to the GSSHA Model, by Aaron Byrd and Cary Talbot
- Watershed Analysis Tool: HEC-WAT Program, by Chris Dunn
- Little Calumet River UnsteadLittle Calumet River Unsteady Flow Model Conversion UNET to HEC-RAS, by Rick D. Ackerson
  Kansas River Basin Model, by Edward Parker
- Design Guidance for Breakup Ice Control Structures, by Andrew M. Tuthill
- Computational Hydraulic Model of the Lower Monumental Dam Forebay, by Richard Stockstill, Charlie Berger, John Hite, Alex Carrillo, and Jane Vaughan
- Use of Regularization as a Method for Watershed Model Calibration, by Brian Skahill
- Demonstration Program Urban Flooding and Channel Restoration in Arid and Semi-Arid Regions (UFDP), by Joan Pope, Jack Davis, Ed Sing, John Warwick, Meg Jonas

Track 5

- Walla Walla District Northwestern Division, by Robert Berger
- Best Practices for Conduits through Embankment Dams, by Chuck R. Cooper
- Design, Construction Design, Construction and Seepage at Prado Dam, by Douglas E. Chitwood
- 2-D Liquefaction Evaluation with Q4Mesh, by David C. Serafini
- Unlined Spillway Erosion Risk Assessment, by Johannes Wibowo, Don Yule, Evelyn Villanueva and Darrel Temple
- Seismic Remediation of the Clemson Upper and Lower Diversion Dams; Evaluation, Conceptual Design and Design, by Lee Wooten and Ben Foreman
- Seismic Remediation of the Clemson Upper and Lower Diversion Dams; Deep Soil Mix Construction, by Lee Wooten and Ben Foreman
- Historical Changes in the State of the Art of Seismic Engineering and Effects of those changes on the Seismic Response Studies of Large Embankment Dams, by Sam Stacy
- Iwakuni Runway Relocation Project, by Vincent R. Donnally
- Internal Erosion & Piping at Fern Ridge Dam, by Jeremy Britton
- Rough River Dam Safety Assurance Project, by Timothy M. O'Leary
- Seepage Collection & Control Systems: The Devil is in the Details , by John W. France
- Dewey Dam Seismic Assessment, by Greg Yankey
- Seismic Stability Evaluation for Ute Dam, New Mexico, by John W. France
- An Overview of Criteria Used by Various Organizations for Assessment and Seismic Remediation of Earth Dams, by Jeffrey S. Dingrando
- A Review of Corps of Engineers Levee Seepage Practices and Proposed Future Changes, by George Sills
- Ground-Penetrating Radar Applications for the Assessment of Pavements, by Lulu Edwards and Don R. Alexander
- Peru Road Upgrade Project, by Michael P. Wielputz
- Slope Stability Evaluation of the Baldhill Dam Right Abutment, by Neil T. Schwanz
- Design and Construction of Anchored Bulkheads with Synthetic Sheet Piles Seabrook, New Hampshire, by Siamac Vaghar and Francis Fung
- Characterization of Soft Claya Case Study at Craney Island, by Aaron L. Zdinak
- Dispersive ClayDispersive Clays – Experience andHistory of the NRCS (Formerly SCS), by Danny McCook
- Post-Tensioning Institute, by Michael McCray
- Demonstration Program Urban Flooding and Channel Restoration in Arid and Semi-Arid Regions (UFDP), by Joan Pope, Jack Davis, Ed Sing, John Warwick, Meg Jonas

Track 6

- State of the Art in Grouting: Dams on Solution Susceptible or Fractured Rock Foundations, by Arthur H. Walz
- Specialty Drilling, Testing, and Grouting Techniques for Remediation of Embankment Dams, by Douglas M. Heenan
- Composite Cut-Offs for Dams, by Dr. Donald A. Bruce and Trent L. Dreese
- State of the Art in Grout Mixes, by James A. Davies
- State of the Art in Computer Monitoring and Analysis of Grouting, by Trent L. Dreese and David B. Wilson
- Quantitatively Engineered Grout Curtains, by David B. Wilson and Trent L. Dreese
- Grout Curtains at Arkabutla Dam: Outlet Monolith Joints and Cracks using Chemical Grout, Arkabutla Lake, MS, by Dale A. Goss
- Chicago Underflow Plan – CUP: McCook Reservoir Test Grout Program, by Joseph A. Kissane
- Clearwater Dam: Sinkhole Repair Foundation Investigation and Grouting Project, by Mark Harris
- Update on the Investigation of the Effects of Boring Sample Size (3" vs 5") on Measured Cohesion in Soft Clays, by Richard Pinner and Chad M. Rachel
- Soil-Bentonite Cutoff Wall Through Free-Product at Indiana Harbor CDF, by Joe Schulenberg and John Breslin
- Soil-Bentonite Cutoff Wall Through Dense Alluvium with Boulders into Bedrock, McCook Reservoir, by William A. Rochford
- Small Project, Big Stability Problem the Block Church Road Experience, by Jonathan E. Kolber
- Determination of Foundation Rock Properties Beneath Folsom Dam, by Michael K. Sharp, José L. Llopis and Enrique E. Matheu
  Waterbury Dam Mitigation, by Bethany Bearmore
- Armor Stone Durability in the Great Lakes Environment, by Joseph A. Kissane
- Mill Creek - An Urban Flood Control Challenge, by Monica B. Greenwell
- Next Stop, The Twilight Zone, by Troy S. O'Neal
- Limitations in the Back Analysis of Shear Strength from Failures, by Rick Deschamps and Greg Yankey
- Reconstruction of Deteriorated Concrete Lock Walls After Blasting and Other Demolition Removal Techniques, by Stephen G. O'Connor

- Flood Fighting Structures Demonstration and Evaluation Program (FFSD), by George Sills
- Innovative Design Concepts Incorporated into a Landfill Closure and Reuse Design Portsmouth Naval Shipyard, Kittery, Maine, by Dave Ray and Kevin Pavlik
- Laboratory Testing of Flood Fighting Structures, by Johannes L. Wibowo, Donald L. Ward and Perry A. Taylor
- Bluff Stabilization Along Lake Michigan, Using Active and Passive Dewatering Techniques, Allegan Co. Michigan, by Rennie Kaunda, Eileen Glynn, Ron Chase, Alan Kehew and Jim Selegean

Track 7

- Case History: Multiple Axial Statnamic Tests on a Drilled Shaft Embedded in Shale, by Paul J. Axtell, J. Erik Loehr, Daniel L. Jones
- The Sliding Failure of Austin Dam Pennsylvania - Revisited, by Brian H. Greene
- M3 –Modeling, Monitoring and Managing: A Comprehensive Approach to Controlling Ground Movements for Protection of Existing Structures and Facilities, by Francis D. Leathers and Michael P. Walker
- Time-Dependent Reliability Modeling for Use in Major Rehabilitation of Embankment Dams and Foundation, by Robert C. Patev
- Lateral Pile Load Test Results Within a Soft Cohesive Foundation, by Richard J. Varuso
- Engineering Geology Challenge Engineering Geology Challenges During Design and Construction of the Marmet Lock Project, by Ron Adams and Mike Nield
- Mill Creek Deep Tunnel Geologic Conditions and Potential Impacts on Design/Construction, by Kenneth E. Henn III
- McAlpine Lock Replacement Instrumentation: Design, Construction, Monitoring, and Interpretation, by Troy S. O’Neal
- Geosynthetics and Construction of the Second Powerhouse Corner Collector Surface Flow Bypass Project, Bonneville Lock and Dam Project, Oregon and Washington, by Art Fong
- McAlpine Lock Replacement Project Foundation Characteristics and Excavation, by Kenneth E. Henn III
- Structural and Geotechnical Issues Impacting The Dalles Spillwall Construction and Bay 1 Erosion Repair, by Jeffrey M. Ament
  Rock Anchor Design and Construction: The Dalles Dam Spillwalls, by Kristie M. Hartfeil
- The Future of the Discrete Element Method in Infrastructure Analysis, by Raju Kala, Johannes L. Wibowo and John F. Peters
- Sensitive Infrastructure Sites - Sonic Drilling Offers Quality Control and Non-Destructive Advantages to Geotechnical Construction Drilling, by John P. Davis

Track 8

- Evaluation of The Use of LithiuEvaluation of The Use of Lithium Compounds in Controlling ASR in Concrete Pavement, by Mike Kelly
- Roller Compacted Concrete for McAlpine Lock Replacement, by David E. Kiefer
- Soil-Cement for Stream Bank Stabilization, by Wayne Adaska
- Using Cement to Reclaim Asphalt Pavements, by David R. Luhr
- Valley Park 100-Yr Flood Protection Project: Use of ‘Engineered Fill’ in the Item IV-B Levee Core, by Patrick J. Conroy
- Bluestone Dam: AAR –A Case Study, by Greg Yankey
- USDA Forest Service: Unpaved Road Stabilization with Chlorides, by Michael R. Mitchell
- Use of Ultra-Fine Amorphous Colloidal Silica to Produce a High-Density, High-Strength Grout, by Brian H. Green
- Modular Gabion Systems, by George Ragazzo
- Addressing Cold Regions Issues in Pavement Engineering, by Edel R. Cortez and Lynette Barna
- Geology of New York Harbor: Geological and Geophysical Methods of Characterizing the Stratigraphy for Dredging Contracts, by Ben Baker, Kristen Van Horn and Marty Goff
- Rubblization of Airfield Concrete Pavements, by Eileen M. Vélez-Vega
- US Army Airfield Pavement Assessment Program, by Haley Parsons, Lulu Edwards, Eileen Velez-Vega and Chad Gartrell
- Critical State for Probabilistic Analysis of Levee Underseepage, by Douglas Crum,
- Curing Practices for Modern Concrete Production, by Toy Poole
- AAR at Carters Dam: Different Approaches, by James Sanders
- Concrete Damage at Carters Dam, by Toy Poole
  Damaging Interactions Among Concrete Materials, by Toy Poole
- Economic Effects on Construction of Uncertainty in Test Methods, by Toy Poole
- Trends in Concrete Materials Specifications, by Toy Poole
- Spall and Intermediate-Sized Repairs for PCC Pavements, by Reed Freeman and Travis Mann
- Acceptance Criteria Acceptance Criteria for Unbonded Aggregate Road Surfacing Materials, by Reed Freeman, Toy Poole, Joe Tom and Dale Goss
- Effective Partnering to Overcome an Interruption In the Supply of Portland Cement During Construction at Marmet Lock and Dam, by Billy D. Neeley, Toy S. Poole and Anthony A. Bombich

Track 10

- Marmet Lock &Dam: Automated Instrumentation Assessment, Summer/Fall 2004, by Jeff Rakes and Ron Adams
  Success Dam Seismic Remediation

Track 9

- Fern Ridge Dam, Oregon: Seepage and Piping Concerns (Internal Erosion)

Track 11

- Canton Dam Spillway Stability: Is a Test Anchor Program Necessary?, by Randy Mead
- Dynamic Testing and Numerical Correlation Studies for Folsom Dam, by Ziyad Duron, Enrique E. Matheu, Vincent P. Chiarito, Michael K. Sharp and Rick L. Poeppelman

Status of Portfolio Risk Assessment, by Eric Halpin
- Mississinewa Dam Foundation Rehabilitation, by Jeff Schaefer
- Wolf Creek Dam Seepage Major Rehabilitation Evaluation, by Michael F. Zoccola
- Bluestone Dam DSA Anchor Challenges, by Michael McCray
- Clearwater Dam Major Rehab Project, by Bobby Van Cleave
- Design, Construction and Seepage at Prado Dam, by Douglas E. Chitwood
- Seven Oaks Dam: Outlet Tunnel Invert Damage, by Robert Kwan
- An Overview of An Overview of the Dam Safety ProgramManagement Tools (DSPMT), by Tommy Schmidt

Track 12

- Greenup L&D Miter Gate Repair and Instrumentation, by Joseph Padula, Bruce Barker and Doug Kish
- Marmet Locks and Dam Lock Replacement Project, by Jeffrey S. Maynard,
- Status of HSS Inspections in The Portland District, by Travis Adams
- Kansas City District: Perry Lake Project Gate Repair, by Marvin Parks
- Mel Price – Auxiliary Lock Downstream Miter Gate Repair, by Thomas J. Quigley, Brian K. Kleber and Thomas R. Ruf
- J.T. Myers Lock Improvements Project Infrastructure Conference, by David Schaaf and Greg Werncke
- J.T. Myers Dam Major Rehab, by David Schaaf, Greg Werncke and Randy James
- Greenup L&D, by Rodney Cremeans
- McAlpine Lock Replacement Project, by Kathy Feger
- Roller Compacted Concrete Placement at McAlpine Lock, by Larry Dalton
- Kentucky Lock Addition Downstream Middle Wall Monolith Design, by Scott A. Wheeler
- London Locks and Dam Major Rehabilitation Project, by David P. Sullivan
- Replacing Existing Lock 4: Innovative Designs for Charleroi Lock, by Lisa R. Pierce, Dave A. Stensby and Steve R. Stoltz
- Olmsted L&D, Dam In-the-wet Construction, by Byron McClellan, Dale Berner and Kenneth Burg
- Olmsted Floating Approach Walls, by Terry Sullivan
- John Day Navigation Lock Monolith Repair, by Matthew D. Hanson
- Inner Harbor Navigation Canal (IHNC) Lock Replacement, by Mark Gonski
- Comite River Diversion Project, by Christopher Dunn
- Waterline Support Failure: A Case Study, by Angela DeSoto Duncan
- Public Appeal of Major Civil Projects: The Good, the Bad and the Ugly, by Kevin Holden and Kirk Sunderman
- Chickamauga Lock and Dam Lock Addition Cofferdam Height Optimization Study, by Leon A. Schieber
- Des Moines Riverwalk, by Thomas D. Heinold

Track 13

- Folsom Dam Evaluation of Stilling Basin Performance for Uplift Loading for Historic Flows and Modification of Folsom Dam
- Stilling Basin for Hydrodynamic Loading, by Rick L. Poeppelman, Yunjing (Vicky) Zhang, and Peter J. Hradilek
- Seismic Stress Analysis of Folsom Dam, by Enrique E. Matheu
- Barge Impact Analysis for Rigid Lock Walls ETL 1110-2-563, by John D. Clarkson and Robert C. Patev
- Belleville Locks & Dam Barge Accident on 6 Jan 05, by John Clarkson
- Portugues Dam Project Update, by Alberto Gonzalez, Jim Mangold and Dave Dollar
- Portugues Dam: RCC Materials Investigation, by Jim Hinds
- Nonlinear Incremental Thermal Stress Strain Analysis Portugues Dam, by David Dollar, Ahmed Nisar, Paul Jacob and Charles Logie
- Seismic Isolation of Mission-Critical Infrastructure to Resist Earthquake Ground Shaking or Explosion Effects, by Harold O. Sprague, Andrew Whitaker and Michael Constantino
- Obermeyer Gated Spillway S381, by Michael Rannie
- Design of High Pressure Vertical Steel Gates Chicago Land Underflow Plan McCook Reservoir, by Henry W. Stewart, Hassan Tondravi, Lue Tekola,
- Development of Design Criteria for the Rio Puerto Nuevo Contract 2D/2E Channel Walls, by Janna Tanner, David Shiver, and Daniel Russell
- Indianapolis NortIndianapolis North Phase 3A Warfleigh Section
- Design of Concrete Lined Tunnels in Rock CUP McCook Reservoir Distribution Tunnels Contract, by David Force

Track 14

- GSA Progressive Collapse Design Guidelines Applied to Concrete Moment-Resisting Frame Buildings, by David N. Bilow and Mahmoud E. Kamara,
- UFC 4-023-02 Retrofit of Existing Buildings to Resist Explosive Effects, by Jim Caulder
- Summit Bridge Fatigue Study, by Jim Chu
- Quality Assurance for Seismic Resisting Systems, by John Connor
- Seismic Requirements for Arch, Mech, and Elec. Components, by John Connor
- SBEDS - (Single degree of freedom Blast Effects Design Spreadsheets), by Dale Nebuda,
- Design of Buildings to Resist Progressive Collapse UFC 4-023-03, by Bernie Deneke,
- Fatigue and Fracture Assessment, by Jesse Stuart
- Unified Facilities Criteria: Seismic Design for Buildings, by Jack Hayes
- Evaluation and Repair Of Blast Damaged Reinforced Concrete Beams, by MAJ John L. Hudson
- Building an In-house Bridge Inspection Program
- United Facilities CriteriUnited Facilities Criteria Masonry Design for Buildings, by Tom Wright
- USACE Homeland Security Portal, by Michael Pace
- Databse Tools for Civil Works Projects

- Standard Procedure for Fatigue Evaluation of Bridges, by Phil Sauser
- Consolidation of Structural Criteria for Military Construction, by Steven Sweeney
- Cathodic Protectionfor the South Power Plant Reinforcing Steel, Diego Garcia, BIOT, by Thomas Tehada and Miki Funahashi

Track 15

- Engineering Analysis of Airfield Lighting System Lightning Protection, by Dr. Vladimir A. Rakov and Dr. Martin A. Uman
- Dr. Martin A. Uman
- Charleston AFB Airfield Lighting Vault
- UNIFIED FACILITIES CRITERIA (UFC) UFC 3-530-01 Design: Interior, Exterior Lighting and Controls, by Nancy Clanton and Richard Cofer
- Electronic Keycard Access Locks, by Fred A Crum
- Unified Facilities Criteria (UFC) 3-560-02, Electrical Safety, by John Peltz and Eddie Davis
- Electronic Security SystemElectronic Security Systems Process Overview
- Lightning Protection Standards
- Electrical Military Workshop
- Information Technology Systems Criteria, by Fred Skroban and John Peltz
- Electrical Military Workshop
- Electrical Infrastructure in Iraq- Restore Iraqi Electricity, by Joseph Swiniarski

Track 16

- BACnet® Technology Update, by Dave Schwenk
- The Infrastructur Conference 2005, by Steven M. Carter Sr. and Mitch Duke
- Design Consideration for the Prvention of Mold, by K. Quinn Hart
- COMMISSIONING, by Jim Snyder
- New Building Commissioning , by Gary Bauer
- Ventilation and IAQ TheNew ASHRAE Std 62.1, by Davor Novosel
- Basic Design Considerations for Geothermal Heat Pump Systems, by Gary Phetteplace
- Packaged Central Plants
- Effective Use Of Evaporative Cooling For Industrial And Institutional/Office Facilities, by Leon E. Shapiro
- Seismic Protection For Mechanical Equipment
- Non Hazardous Chemical Treatments for Heating and Cooling Systems, by Vincent F. Hock and Susan A. Drozdz
- Trane Government Systems & Services
- LONWORKS Technology Update, by Dave Schwenk
- Implementation of Lon-Based Specifications by Will White and Chris Newman

Track 17

- Utility System Security and Fort Future, by Vicki Van Blaricum, Tom Bozada, Tim Perkins, and Vince Hock
- Festus/Crystal City Levee and Pump Station
- Chicago Underflow Plan McCook Reservoir (CUP) Construction of Distribution Tunnel and Pumps Installation
- Technological Advances in Lock Control Systems, by Andy Schimpf and Mike Maher
- Corps of Engineers in Iraq Rebuilding Electrical Infrastructure, by Hugh Lowe
- Red River of the North at East Grand Forks, MN & Grand Forks, ND: Flood Control Project – Armada of Pump Stations Protect Both Cities, by Timothy Paulus
- Lessons Learned for Axial/Mixed Flow Propeller Pumps, by Mark A. Robertson
- Creek Automated Gate Considerations, by Mark A. Robertson
- HydroAMP: Hydropower Asset Management, by Lori Rux
- Acoustic Leak Detection for Water Distribution Systems, by Sean Morefield, Vincent F. Hock and John Carlyle
- Remote Operation System, Kaskaskia Dam Design, Certification, & Accreditation, by Shane M. Nieukirk
- Lock Gate Replacement System, by Shaun A. Sipe and Will Smith

Track 20

- “Re-Energizing Medical Facility Excellence”, by COL Rick Bond
- Rebuilding and Renovating The Pentagon , by Brian T. Dziekonski,
- Resident Management System
- Design-Build and Army Military Construction, by Mark Grammer
- Defense Acquisition Workforce Improvements Act - Update, by Mark Grammer
- Construction Management @ Risk: Incentive Price Revision – Successive Targets, by Christine Hendzlik
- Construction Reserve Matrix, by Christine Hendzlik
- Award contingent on several factors..., by Christine Hendzlik
- 52.216-17 Incentive Price Revision--Successive Targets (Oct 1997) - Alt I (Apr 1984), by Christine Hendzlik
- Preconstruction Services, by Christine Hendzlik
- Proposal Evaluation Factors, by Christine Hendzlik
- MILCON Transformation in Support of Army Transformation, by Claude Matsui
- Construction Practices in Russia, by Lance T. Lawton

- Partnering as a Best Practice, by Ray Dupont
- USACE Tsunami Reconstruction for USAID, by Andy Constantaras

Track 21

- Dredging Worldwide, by Don Carmen
- SpecsIntact Editor, by Steven Freitas
- SpecsIntact Explorer, by Steven Freitas
- American River Watershed Project, by Steven Freitas
- Unified Facilities Guide Specifications (UFGS) Conversion To MasterFormat 2004, by Carl Kersten
- Unified Facilities Guide Specifications (UFGS) Status and Direction , by Jim Quinn

Workshops

- Design of Buildings to Resist Progressive Collapse UFC 4-023-03, by Bernie Deneke
- Security Engineering and at Unified Facility Criteria (UFC), by Bernie Deneke, Richard Cofer, John Lynch and Rudy Perkey
- Packaged Central Plants, by Trey Austin

NATIONAL DEFENSE INDUSTRIAL ASSOCIATION

STRENGTH THROUGH INDUSTRY & TECHNOLOGY

2005 Tri-Service Infrastructure Systems Conference & Exhibition

"Re-Energizing Engineering Excellence"

ON-SITE AGENDA

The America's Center
St. Louis Convention Center
St. Louis, MO
August 2-4, 2005
Event # 5150

Tri-Service Infrastructure Systems Conference & Exposition 2005

AGENDA

Monday, August 1, 2005

8:00 AM-9:00 PM	Exhibit Move-In
12 Noon-5:00 PM	Registration

Tuesday, August 2, 2005

7:00 AM-8:00 AM	Registration and Continental Breakfast
8:00 AM-8:15 AM Ferrara Theatre	Welcome and Introduction
8:15 AM-9:00 AM Ferrara Theatre	The Future of Engineering and Construction Panel Moderator: *Mr. Don Basham, Chief, Engineering & Construction, USACE* Panelists: *LTG Carl A. Strock, Commander, USACE* *Dr. James Wright, Chief Engineer NAVFAC*
9:00 AM-9:45 AM Ferrara Theater	Keynote Address The Lord of the Things: The Future of Infrastructure Technologies *Mr. Paul Doherty, AIA, Managing Director,* *General Land Corporation*
9:45 AM-10:15 AM	Break
10:15 AM-11:15 AM Ferrara Theatre	USACE Engineering and Construction Panel Moderator: *Mr. Don Basham, Chief, Engineering & Construction, USACE* Panelists: *MG Donald T. Riley, Director, Civil Works, USACE* *BG Bo M. Temple, Director, Military Programs, USACE* *Dr. Michael J. O'Connor, Director, R&D*
10:15 AM-11:15 AM Room 225	Navy General Session
11:00 AM - 7:00 PM	Exhibits Open
11:15 AM-1:00 PM	Lunch in Exhibit Hall (on your own)
11:15 AM-1:00 PM Washington G	Women's Career Lunch Session (Bring your lunch from Exhibit Hall) Moderator: *Ms. Demi Syriopoulou, HQ USACE* Opening Remarks: *LTG Carl A. Strock, Commander, USACE* Presentations & Discussion: *Dwight Beranek, Kristine Allaman, Donald Basham, HQ USACE*
1:00 PM-1:55 PM Ferrara Theatre	Introduction to Multi-Disciplinary Tracks

Tuesday, August 2, 2005

2:00 PM-2:50 PM — 1st Round of Multi-Disciplinary Concurrent Sessions (Continued)

Track 1: Acquisition Strategies for Civil Works
Room 230
Walt Norko

Track 2: Risk and Reliability Engineering
Room 231
Anjana Chudgar
David Schaaf

Track 3: Portfolio Risk Assessment
Room 232
Eric Halpin

Track 4: Hydrology, Hydraulics and Coastal Engineering Support for USACE
Room 240
Jerry Webb
Darryl Davis

Track 5: Civil Works R&D Forum
Room 241
Joan Pope

Track 6: Civil Works Security Engineering
Room 242
Joe Hartman
Bryan Cisar

Track 7: Building Information Model Applications
Room 226
Brian Huston
Daniel Hawk

Track 8: Design Build for Military Projects
Room 220
Mark Grammer

Track 9: Army Transformation/Global Posture Initiative/ Force Modernization
Room 221
Al Young
Claude Matsui

Track 10: Force Protection - Army Access Control Points
Room 222
John Trout

Track 11: Cost Engineering Forum on Government Estimates vs. Actual Costs
Room 227
Ray Lynn — *Jack Shelton* — *Kim Callan*
Miguel Jumilla — *Ami Ghosh* — *Joe Bonaparte*

Track 12: Engineering & Construction Information Technology
Room 228
MK Miles

Track 13: Sustainable Design
Room 223
Harry Goradia

Track 14: ACASS/CCASS/CPARS
Room 224
Ed Marceau
Marilyn Nedell

Track 15: Whole Building Design Guide
Room 229
Earle Kennett

Tuesday, August 2, 2005

2:50 PM-3:30 PM	Break in Exhibit Hall
3:30 PM-4:20 PM	2nd Round of Multi-Disciplinary Sessions
4:30 PM-5:20 PM	3rd Round of Multi-Disciplinary Sessions
5:30 PM-7:00 PM	Ice Breaker Reception in Exhibit Hall

Wednesday, August 3, 2005

7:00 AM-8:00 AM	Registration and Continental Breakfast
8:00 AM-9:30 AM	Concurrent Sessions (Please Refer to Concurrent Session Schedule on the Following Pages)
9:00 AM	Exhibit Hall Opens
9:30 AM-10:30 AM	Break in Exhibit Hall
10:30 AM-12:00 Noon	Concurrent Sessions (Please Refer to Concurrent Session Schedule on the Following Pages)
12:00 Noon-1:30 PM	Lunch in Exhibit Hall
1:30 PM-3:00 PM	Concurrent Sessions (Please Refer to Concurrent Session Schedule on the Following Pages)
3:00 PM-4:00 PM	Break in Exhibit Hall
4:00 PM-5:30 PM	Concurrent Sessions
5:00 PM	Exhibit Hall Closes

Thursday, August 4, 2005

7:00 AM-8:00 AM	Registration and Continental Breakfast
8:00 AM-9:30 AM	Concurrent Sessions (Please Refer to Concurrent Session Schedule on Following Pages)
9:30 AM-10:30 AM	Break in Exhibit Hall (Last Chance to view Exhibits)
10:30 AM-12:00 Noon	Concurrent Sessions (Please Refer to Concurrent Session Schedule on Following Pages)
12:00 Noon-1:30 PM	Lunch (On your own)
12:00 Noon-6:00 PM	Exhibits Move-Out
1:30 PM-3:00 PM	Concurrent Sessions (Please Refer to Concurrent Session Schedule on Following Pages)
3:00 PM-3:30 PM	Break
3:30 PM-5:00 PM	Concurrent Sessions (Please Refer to Concurrent Session Schedule on following pages)

Wednesday, August 3, 2005 Concurrent Sessions

HH&C Track

Room	Track	8:00 AM	8:30 AM	9:00 AM	9:30 AM	Track	10:30 AM	11:00 AM	11:30 AM
Room 220	**TRACK 1** Coastal Structures Session 1A	Protecting the NJ Coast using large stone seawalls *Cameron Chasten*	Chicago shoreline storm damage reduction project *Andrew Bezinger*	Risk and reliability in coastal structure design *Jeffrey Melby*	Break in Exhibit Hall	**TRACK 1** Coastal Regional Manangement Session 1B	Cascade: An integrated regional model for decision support *Nicholas Kraus*	Upper Texas coast sediment transport modeling & sediment budgets *David King*	Sediment compatibility for beach nourishment in North Carolina *Gregory Williams*
Room 221	**TRACK 2** Ecological Engineering & Design Session 2A	Ecological and engineering considerations for dam decommissioning, retrofits and operations *Jock Conyngham*	Hydraulic design of tidegates and other water control structures for ecosystem restoration on the Columbia Estuary *Patrick O'Brien*	Innovative Integration of engineering and biological tools aids hydraulic structure design for restoring T&E fish *Andrew Goodwin*	Break in Exhibit Hall	**TRACK 2** Ecological Engineering & Design Session 2B	Innovative hydraulic structure design at Lower Granite Dam: design that saves water and salmon *Lynn Reese*	Impacts of using a spillway for juvenile fish passage on typical design criteria *Robert Buchholz*	Hydraulic design of juvenile fish passage facility for reservoir with wide range of pool elevation - Hanson Dam *Dennis Mekkers*
Room 222	**TRACK 3** Modeling Session 3A	Corps involvement in the FEMA map modernization program *Kete White*	Innovative approximate study method for FEMA map modernization program *John Hunter*	Flood fight structures demonstration evaluation program *Fred Pinkard*	Break in Exhibit Hall	**TRACK 3** Modeling Session 3B	Integrating climate dynamics into water resources planning and management *Kate White*	Risk and uncertainty in flood damage reduction studies *Rob Moyer*	Uncertainty analysis and stochastic simulation *Jacke Hallberg*
Room 223	**TRACK 4** H&H Aspects of Dam Safety Session4A	Hydrologic aspects of operating in failure mode: Fern Lake *Bruce Duffe*	Dam safety study with cascading failures *Gordon Lance*	Rough river spillway capacity *Richard Pruitt*	Break in Exhibit Hall	**TRACK 4** International / Military H&H Session 4B	Capability restoration and historic marsh restoration *Fauwaz Hanbali*	USACE capacity building effort for Iraq MoWR *Steven Wilhelms*	USACE support of CMEP in 2004 *Mark Jensen*

12 Noon **Lunch in Exhibit Hall**

Room	Track	1:30 PM	2:00 PM	2:30 PM	3:00 PM	Track	4:00 PM	4:30 PM	5:00 PM
Room 220	**TRACK 1** Coastal Sediments Session 1C	Evaluating beachfill project performance in the NAP *Monica Chasten*	USACE's regional coastal mapping program *Jennifer Wozencraft*	US Naval Academy flood damage reduction project using structural and non-structural measures *Stacey Underwood*	Break in Exhibit Hall	**TRACK 1** Shore Protection Projects Session 1D	Hurricane Isabel effects on communities *Jane Jablonski*	Repair of the shore protection projects adversly affected by the hurricanes of 2004 *Rick McMillen*	Shore protection project performance assessmet *Sharon Haggett*
Room 221	**TRACK 2** Modeling Ecological Restoration / Systems Assessment Session 2C	Regional modeling requirements for ecosystem restoration *Maged Hussein*	Tools for wetlands permit evaluation: Modeling groundwater and surface water distribution systems *Cary Talbot*	Current research in fate and transport of chemical and biological contaminants in water distribution systems *Mark Ginsberg*	Break in Exhibit Hall	**TRACK 2** Ecosystem Habitat Restoration Session 2D	Aquatic habitat restoration in the lower Missouri River *Chance Bittner*	Missouri River restoration: shallow water habitat creation *Daniel Pridal*	Ecosystem restoration for fish and wildlife habitat on the upper Mississippi River *Jon Hendrickson*
Room 222	**TRACK 3** River Morphology Session 3C	Geomorphology study of the Mississippi river *Edward Braurer*	Bank erosion and morphology of the Kaskaskia river *Michael Rodgers*	Sediment movement at Kansas City from water years 1920 to 2004 *Alan Tool*	Break in Exhibit Hall	**TRACK 3** Modeling River Sedimentation Session 3D	Sediment impact assessment model (SIAM) *David Biedenharn*	Sediment modeling of MS River, Cairo to Gulf *Basil Arthur*	Sediment modeling of rivers *Charlie Berger*
Room 223	**TRACK 4** GIS and Surveying Session 4C	GIS tools available now to support HHC *Timothy Pangburn*	High resolution bathymetry and fly-through visualization *Paul Clouse*	GIS & surveying to support national FEMA *Mark Flick*	Break in Exhibit Hall	**TRACK 4** GIS and Surveying Session 4D	Update flood emergency plans with GIS and HEC-RAS *Stephen Stello*	High resolution visualizations of multibeam data: lower Mississippi River *Thomas Tobin*	GIS in SWWRP *Andrew Bruzewicz*

Wednesday, August 3, 2005 Concurrent Sessions

Geotechnical Track

Room	Track / Session	8:00 AM	8:30 AM	9:00 AM	9:30 AM	10:30 AM	11:00 AM	11:30 AM
Room 226	TRACK 5 Session 5A	Levee lowering for the Lewis & Clark bi-centennial celebration *Robert Berger*	Conduits through embankment dams - best practices for design, construction, problem id and evaluation, inspection, maintenance, renovation & repair *Dave Pezza*	Design, construction and seepage at Prado Dam, CA *Douglas Chitwood*	Break in Exhibit Hall	TRACK 5 Session 5B: 2-D liquefaction evaluation with q4MESH *David Serafini*	Unlined spillway erosion risk assessment *Johannes Wibowo*	Seismic remediation of the Clemson upper and lower diversion dams: evaluation, conceptal design and design (P1) *Ben Foreman*
Room 227	TRACK 6 Session 6A	USACE dams on solution susceptible or highly fractured rock foundations *Art Walz*	Special drilling and grouting techniques for remedial work in embankment dams *Doug Heenan*	Composite grouting & cutoff wall solutions *Donald Bruce*	Break in Exhibit Hall	TRACK 6 Session 6B: State of the art in grout mixes *James Davies*	State of the art in computer monitoring, control, and analysis of grouting *Trent Dreese*	Quantitatively engineered grout courtains *David Wilson*
Room 228	TRACK 7 Session 7A	Case history: multiple axial statnamic test on a drilled shaft embedded in shale *Paul Axtell*	Austin Dam, Pennsylvania: the sliding failure of a concrete gravity dam revisited *Brian Greene*	M^3 (Modeling, Monitoring and Manufacturing) - a comprehensive approach to controlling ground movements for protecting existing structures and facilities *Michael Walker*	Break in Exhibit Hall	TRACK 7 Session 7B: Controlled modulus columns: A ground improvement technique *Martin Taube*	Time-dependent reliability models for use in major rehabilitation of embankment dams and foundations *Robert Patev*	Engineering geology design challenges at the Soo Lock replacement project *Mike Nield*
Room 229	TRACK 8 Session 8A	Evaluation of the use of lithium nitrate in controlling alkali-silica reactivity in an existing concrete pavement *Mike Kelly*	Use of self-consolidating concrete in the installation of bulhead slots - Lessons learned in the use of this innovative concrete material *Darrell Morey*	Roller compacted concrete for McAlpine lock walls *David Kiefer*	Break in Exhibit Hall	TRACK 8 Session 8B: Soil-cement for stream bank stabilization *Wayne Adaska*	Using cement to reclaim asphalt pavements *David Luhr*	Valley park 100-year flood protection project: use of “engineered fill” in item 4b levee core *Patrick Conroy*

12 Noon **Lunch in Exhibit Hall**

Room	Track / Session	1:30 PM	2:00 PM	2:30 PM	3:00 PM	4:00 PM	4:30 PM	5:00 PM
Room 226	TRACK 5 Session 5C	Seismic remediation of the Clemson upper and lower diversion dams: deep soil mix construction *Ben Foreman*	Historical changes in the state-of-the-art of seismic engineering & effects of those changes on the seismic response studies of large embankement dams *Samuel Stacy*	New Iwakuni runway *Vincent Donnally*	Break in Exhibit Hall	TRACK 5 Session 5D: Internal erosion and piping at Fern Ridge dam: Problems and solutions *Jeremy Britton, Ph.D.*	Rough river dam safety assurance project *Timothy O’Leary*	Seepage collection and control systems: The devil is in the details *John France*
Room 227	TRACK 6 Session 6C	Grout courtains at Arkabutla Dam outlet monolith joints using chemical grout to seal joints, Arkabutla, MS *Dale Goss*	Results from a large-scale grout test program, Chicago underflow plan (CUP) McCook Reservoir *Joseph Kissane*	Clearwater Dam - foundation drilling and grouting for repair of sinkholes *Mark Harris*	Break in Exhibit Hall	TRACK 6 Session 6D: Update on the investigation of the effects of boring sample size (3’ vs 5”) on measured cohesion in soft clays *Richard Pinner*	Soil-bentonite cutoff wall through free-product at Indiana Harbor CDF *Joseph Schulenberg*	Soil-bentonite cutoff wall through dense alluvium with boulders into bedrock, McCook Reservoir *William Rochford*
Room 228	TRACK 7 Session 7C	Engineering geology during design and construction of the Marmet lock project *Michael Nield*	Mill Creek deep tunnel - Geological affects on proposed structures and construction techniques *Tres Henn*	Earth pressure loads behind the new McAlpine Lock replacement project *Troy O’Neal*	Break in Exhibit Hall	TRACK 7 Session 7D: Geosynthetics and construction of the Bonneville lock and dam second powerhouse corner collector surface flow bypass project *Art Fong*	McAlpine lock replacement - foundation characteristics and excavation *Kenneth Henn*	
Room 229	TRACK 8 Session 8C	What to do if your dam is expanding: a case study *Greg Yankey*	Unpaved road stabilization with chlorides *Michael Mitchell*	Use of ultra-fine amorphous colloidal silica to produce a high-density, high-strength rock-matching grout for instrumentation grouting *Brian Green*	Break in Exhibit Hall	TRACK 8 Session 8D: Innovative techniques in the Gabion system *George Ragazzo*	Addressing cold regions issues in pavement engineering *Lynette Barna*	Geology of New York Harbor - geological and geophysical methods of characterizing the stratigraphy for dredging contracts *Ben Baker*

Wednesday, August 3, 2005 Concurrent Sessions

Structural Engineering Track

Room	Track / Session	8:00 AM	8:30 AM	9:00 AM	9:30 AM	Track / Session	10:30 AM	11:00 AM	11:30 AM
Room 240	**TRACK 12** Civil Works Structural — **Session 12A**	Recent changes to Corps guidance on steel hydraulic structures *Joe Padula*	Crack repairs and instrumentation of Greenup L&D miter gate *Doug Kish*	Recent hydraulic steel structures findings in the Portland district *Travis Adams*	Break in Exhibit Hall	**TRACK 12** Civil Works Structural — **Session 12B**	Perry Lake gate repair *Marvin Parks*	Mel Price auxiliary lock gate repair *Andrew Schimpf*	Mel Price auxiliary lock gate repair (Continued) *Andrew Schimpf*
Room 241	**TRACK 13** Civil Works Structural — **Session 13A**	Folsom Dam evaluation of stilling basin performance for uplift loading for historic flows *Rick Poeppelman*	Rehabilitation of Folsom Dam stilling basin *Rick Poeppelman*	Seismic stability evaluation of Folson Dam *Enrique Matheu*	Break in Exhibit Hall	**TRACK 13** Civil Works Structural — **Session 13B**	Seismic stress analysis of Folsom Dam *Enrique Matheu*	Barge impact guidance for rigid lock walls, ETL 110-2-563 and probalistic barge impact analysis *John Clarkson*	Belleville barge accident *John Clarkson*
Room 242	**TRACK 14** Bridges/ Buildings — **Session 14A**	The USACE bridge management system *Phil Sauser*	Standard procedures for fatigue evaluation of bridges *Phil Sauser*	Fatigue and fracture assessment of Jesse Stuart Highway Bridge *John Jaeger*	Break in Exhibit Hall	**TRACK 14** Bridges/ Buildings — **Session 14B**	Building an in-house bridge inspection program *Jennifer Laning*	Fatigue analysis of Summit bridge *Jim Chu*	Consolidation of Structural criteria for military construction *Steve Sweeney*

12 Noon — **Lunch in Exhibit Hall**

Room	Track / Session	1:30 PM	2:00 PM	2:30 PM	3:00 PM	Track / Session	4:00 PM	4:30 PM	5:00 PM
Room 240	**TRACK 12** Civil Works Structural — **Session 12C**	Overview of John T. Myers locks improvements project *Greg Werncke*	John T. Myers rehabilitation study *Greg Werncke*	Ohio River Greenup Lock extension *Rodney Cremeans*	Break in Exhibit Hall	**TRACK 12** Civil Works Structural — **Session 12D**	McAlpine lock replacement project, project summary and status of construction *Kathleen Feger*	Results of Roller Compacted concrete placement at the McAlpine lock replacement project *Larry Dalton*	Tennessee Valley authority Kentucky lock addition downstream middle wall monoliths *Scott Wheeler*
Room 241	**TRACK 13** Civil Works Structural — **Session 13C**	Portugues Dam, Ponce, Puerto Rico project update *Jim Mangold*	Portugues Dam, Ponce, Puerto Rico, RCC design and testing program *Jim Hinds*	Portugues Dam, Ponce, Puerto Rico, Thermal analysis of hydration and subsequent cooling of RCC *Ahmed Nisar*	Break in Exhibit Hall	**TRACK 13** Civil Works Structural — **Session 13D**	Miter gate anchorage design *Andy Harkness*	Obermeyer gated spillway project - S381 *Michael Rannie*	McCook Reservoir design of high pressure steel gates *Luelseged Tekola*
Room 242	**TRACK 14** Brigdes/ Buildings — **Session 14C**	Unified facilities criteria seismic design for buildings *Jack Hayes*	Seismic requirements for architectural, mechanical and electrical components *John Connor*	Quality assurance for seismic resisting systems *John Connor*	Break in Exhibit Hall	**TRACK 14** Bridges/ Buildings — **Session 14D**	Unified facilities criteria masonry structural design for buildings *Tom Wright*	Cathodic protection of building reinforcing steel (in Diego Garcia) *Thomas Tehada*	USACE Homeland security web portal *Mike Pace*

Wednesday, August 3, 2005 Concurrent Sessions

Dam Safety Track & Construction Track

Room	Track / Session	8:00 AM	8:30 AM	9:00 AM	9:30 AM	Track / Session	10:30 AM	11:00 AM	11:30 AM
Room 224	**TRACK 10** Dam Safety **Session 10A**	Tuttle Creek warning and alert systems *Bill Empson*	Lessons from the dam failure warning system exercise - Tuttle Creek *Bill Empson*	Tuttle Creek ground modification treatability program *Bill Empson*	Break in Exhibit Hall	**TRACK 10** Dam Safety **Session 10B**	Dam safety analysis of Cannelton Dam *Terry Sullivan*	John Martin Dam, CO - Dam safety structural upgrades *George Diewald*	Vesuvius Lake Dam rehabilitation *Susan Peterson*
Room 225	**TRACK 11** Dam Safety **Session 11A**	Canton lake spillway stabilization project: IS a test anchor program NECESSARY? *Randy Mead*	Dynamic testing and numerical correlation studies for Folsom dam *Ziyad Duron*	Status of portfolio risk assessment *Eric Halpin*	Break in Exhibit Hall	**TRACK 11** Dam Safety **Session 11B**	Mississinewa Dam remediation *Jeff Schaefer*	Wolf creek seepage history *Michael Zoccola*	Blue dam major rehabilitation *Michael McCray*
Room 230	**TRACK 19** Construction **Session 19A**	RMS Update *Haskell Barker*	RMS Update (Continued) *Haskell Barker*	Updated CQM for Contractors Course *Walt Norko*	Break in Exhibit Hall	**TRACK 19** Construction **Session 19B**	Lessons learned on major construction projects *Jim Cox*	Update on safety issues - Safety manual 385-1-1 *Charles Ray Waits*	Update on safety issues - safety manual 385-1-1 (continued) *Charles Ray Waits*
Room 231	**TRACK 20** Construction **Session 20A**	Construction methods in Russia *Lance Lawton*	Construction methods in Russia (Continued) *Lance Lawton*	Renovating the Pentagon using Design/Build delivery *Brian Dziekonski*	Break in Exhibit Hall	**TRACK 20** Construction **Session 20B**	Completion of the Olmsted approach walls *Dale Miller*	Completion of the Olmsted approach walls (Continued) *Dale Miller*	Construction management at risk *Christopher Prinslow*

12 Noon **Lunch in Exhibit Hall**

Room	Track / Session	1:30 PM	2:00 PM	2:30 PM	3:00 PM	Track / Session	4:00 PM	4:30 PM	5:00 PM
Room 224	**TRACK 10** Dam Safety **Session 10C**	Project specific risk analysis - Success Dam *Ronn Ross*	Dam safety lessons learned, Winter storm 2005, Muskingum & Scioto Basins *Charles Barry*	Dam security and Dams Government Coordinating Council *Roy Braden*	Break in Exhibit Hall	**TRACK 10** Dam Safety **Session 10D**	Prompton Dam hydrologic deficiency and spillway modification *Troy Cosgrove*	"Well, that's water over the dam" - Rough River spillway adequacy design *Richard Pruitt*	Roller-compacted concrete for dam spillways and overtopping protection *Fares Abdo*
Room 225	**TRACK 11** Dam Safety **Session 11C**	Clearwater Dam major rehabilitation *Bobby Van Cleave*	Success dam seismic dam safety modification *Norbert Suter*	Problems on the Santa Ana River - Prado Dam *Douglas Chitwood*	Break in Exhibit Hall	**TRACK 11** Dam Safety **Session 11D**	Problems on the Santa Ana River - Seven Oaks Dam *Robert Kwan*	Dam safety program management tools *Tommy Schmidt*	
Room 230	**TRACK 19** Construction **Session 19C**	3D Modeling and impact on constructability *Gary Cough*	3D Modeling and impact on constructability (Continued) *Gary Cough*	Construction in Iraq & Afganistan *Walt Norko*	Break in Exhibit Hall	**TRACK 19** Construction **Session 19D**	Air Force streamlining Design/Build *Joel Hoffman*	Air Force streamlining Design/Build (Continued) *Joel Hoffman*	Sustainable design requirements & construction implementation *Harry Goradia*
Room 231	**TRACK 20** Construction **Session 20C**	Tsunami reconstruction *Andy Constantaras*	Tsunami reconstruction (Continued) *Andy Constantaras*	Military construction transformation in support of Army transformation *Sally Parsons*	Break in Exhibit Hall	**TRACK 20** Construction **Session 20D**	MEDCOM Construction Issues *Rick Bond*	MEDCOM Construction Issues (Continued) *Rick Bond*	*TBA*

Wednesday, August 3, 2005 Concurrent Sessions

Electrical & Mechanical Engineering Track

Room	Track / Session	8:00 AM	8:30 AM	9:00 AM	9:30 AM	Track / Session	10:30 AM	11:00 AM	11:30 AM
Room A	TRACK 15 Military Electrical, Session 15A	Tri-Service Electrical Criteria Overview - *Tri-Service Panel*	Tri-Service Electrical Criteria Overview - (Continued) *Tri-Service Panel*	Tri-Service Electrical Criteria Overview -(Continued) *Tri-Service Panel*	Break in Exhibit Hall	TRACK 15 Military Electrical, Session 15B	Interior/Exterior and security lighting criteria *Tri-Service Panel*	Information technology systems criteria *Tri-Service Panel*	Information technology systems criteria (Continued) *Tri-Service Panel*
Room B	TRACK 16 Military Mechanical, Session 16A	Building Commissioning *Dale Herron*	HVAC Commissioning *Dale Herron*	Ventilation and indoor air quality *Davor Novosel*	Break in Exhibit Hall	TRACK 16 Military Mechanical, Session 16B	Ventilation and indoor air quality (Continued) *Davor Novosel*	Refrigerant implications for HVAC specifications, selection, and o&m - now and future *Mike Thompson*	Refrigerant implications for HVAC specifications, selection, and o&m - now and future (Continued) *Mike Thompson*
Room D	TRACK 17 Military Mechanical / Electrical, Session 17A	Sustainable design update *Harry Goradia*			Break in Exhibit Hall	TRACK 17 Military Mechanical / Electrical, Session 17B	Utility systems security and fort future *Vicki L. Van Blaricum*	Acoustic leak detection for utilities distribution systems *Sean Morefield*	Acoustic leak detection for utilities distribution systems (Continued) *Sean Morefield*
Room E	TRACK 18 Civil Mechanical, Session 18A	Emsworth Dam vertical lift gate hoist replacement *John Nites*	Hydraulic drive for Braddock Dam *Janine Krempa*	John Day navigation lock upstream lift gate wire rope failure *Ronald Wridge*	Break in Exhibit Hall	TRACK 18 Civil Mechanical, Session 18B	Overhead bulkhead at Olmstead Lock *Rick Schultz*	Replacement of gate # 5 intermediate gear and pinion at RC Byrd Lock and Dam *Brenden McKinley*	Mechanical design issues during construction of McAlpine Lock *Richard Nichols*

12 Noon **Lunch in Exhibit Hall**

Room	Track / Session	2:00 PM	2:30 PM	3:00 PM	3:30 PM	Track / Session	4:00 PM	4:30 PM	5:00 PM
Room A	TRACK 15 Military Electrical, Session 15C	Mass notification system *Tri-Service Panel*	Mass notification system (Continued) *Tri-Service Panel*	Electronic card access locks *Fred Crum*	Break in Exhibit Hall	TRACK 15 Military Electrical, Session 15D	Lightning protection standards *Richard Bouchard*	Lightning and surge protection *Tri-Service Panel*	Lightning and surge protection (Continued) *Tri-Service Panel*
Room B	TRACK 16 Military Mechanical, Session 16C	Basic design considerations for geothermal heat pump systems *Gary Phetteplace*	Basic design considerations for geothermal heat pump systems (Continued) *Gary Phetteplace*	Pentagon renovation *Mitch Duke*	Break in Exhibit Hall	TRACK 16 Military Electrical, Session 16D	Effective use of evaporative cooling for industrial and institutional/office facilities *Leon Shapiro*	Efective use of evaporative cooling for industrial and institutional/office facilities (Continued) *Leon Shapiro*	Non-hazardous chemical treatments for heating and cooling systems *Vincent Hock*
Room D	TRACK 17 Civil Mechanical / Electrical, Session 17C	Hydropower asset management partnership (hydroAMP) *Lori Rux*	New gas fueled/diesel fueled turbine powered electrical generating station in Iraq *Lester Lowe*	The construction of distribution tunnels and pump installation for the metropolitan Chicago sewer systems *Ernesto Go*	Break in Exhibit Hall	TRACK 17 Civil Mechanical / Electrical, Session 17D	The Festus/Crystal City levee and pump station project *Stephen Farkas*	Remote operations for Kaskaskia Dam *Shane Nieukirk*	Technological advances in lock control systems *Andy Schimpf*
Room E	TRACK 18 Civil Mechanical, Session 18C	New coating products for civil works structures *Al Beitelman*	New guide specification for procurement of turbine oils *John Micetic*	Synchronous condensing with large Kaplan turbine - A case study *Brian Moentenich*	Break in Exhibit Hall	TRACK 18 Civil Mechanical, Session 18D	Acquifer storage and recovery (ASR) system *Gerald Deloach*	Wastewater infrastructure improvements in Appalachia *James Sadler*	Storm water pumps *Thomas Jamieson*

Thursday, August 4, 2005 Concurrent Sessions

HH&C Track

Room	Track / Session	8:00 AM	8:30 AM	9:00 AM	9:30 AM	Track / Session	10:30 AM	11:00 AM	11:30 AM
Room 220	**TRACK 1 Sedimentation & New Concepts** Session 1E	Ice jams, contaminated sediment and structures Clark Fork River, MT *Andrew Tuthill*	Increased bed erosion due to ice *John Hains*	Monitoring the Mississippi River using GPS coordinated video *James Gutshall*	Break in Exhibit Hall	**TRACK 1 Sedimentation, Case Examples** Session 1F	Watershed approach to stream stability the reduction of nutrients *John B. Smith*	Monitoring the effects of sedimentation from Mount St. Helen *Alan Donner*	Navigation and environmental interests in alleviating repetitive dredging *Jason Brown*
Room 221	**TRACK 2 Water Management** Session 2E	Enhancements and new capabilities of HEC-ResSim 3.0 *Fauwaz Hanbali*	Transition to Oracle based data system *Joel Asunskis*	Accessing real time Mississippi Valley water level data *Rich Engstrom*	Break in Exhibit Hall	**TRACK 2 Water Management** Session 2F	Hurricane Season 2004 *Susan Sylvester*	Reevaluation of a project's flood control benefits *Ferris Chamberlin*	Helmand Valley water management plan *Jason Needham*
Room 222	**TRACK 3 Case Studies** Session 2E	Red River of the north flood protection project *Michael Lesher*	Southeast Arkansas flood control & water supply feasibility study *Thomas Brown*	McCook and Thorton tunnel and reservoir modeling *David Kiel*	Break in Exhibit Hall	**TRACK 3 Case Studies** Session 3F	Ala Wai Canal Project, Honolulu, Oahu, Hawaii *Lynnette Schapers*	Missouri River geospatial decision support framework *Brian Baker*	Systemic analysis of the Mississippi & Illinois Rivers *Dennis Stephens*
Room 223	**TRACK 4 Modeling** Session 4E	Hydrologic models supported by ERDC *Robert Wallace*	HEC-HMS Version 3.0 new features *Jeff Harris*	SEEP2D & GMS: Simple tools for solving a variety of seepage problems *Clarissa Hansen*	Break in Exhibit Hall	**TRACK 4 Modeling** Session 4F	Water quality and sediment transport in HEC-RAS *Mark Jensen*	Advances to the GSSHA program *Aaron Byrd*	Software integration for watershed studies HEC-WAT *Chris Dunn*

12 Noon **Lunch**

Room	Track / Session	1:30 PM	2:00 PM	2:30 PM	3:00 PM	Track / Session	3:30 PM	4:00 PM	4:30 PM
Room 220	**TRACK 1 Water Quality Management** Session 1G	San Francisco Bay Mercury TMDL-Implications for constructed wetlands *Herb Fredrickson*	Abandoned mine land: Eastern and Western perspectives *Kate White*	A lake tap for temperature control tower construction at Cougar Dam *Steve Schlenker*	Break	**TRACK 1 Watershed Management** Session 1H	Demonstrating innovative river restoration technologies: Truckee River, NV *Chris Dunn*	Comprehensive watershed restoration in the Buffalo district *Anthony Friona*	Translating the hydrologic tower of Babel *Dan Crawford*
Room 221	**TRACK 2 Water Management** Session 2G	Developing reservoir operation plans to manage erosion *Patrick O'Brien*	New approaches to water management decision making *James Barton*	Improved water supply forecasts for Kooteny basin using principal components regression *Randal Wortman*	Break	**TRACK 2 Water Management** Session 2H	Prescriptive reservoir modeling and ROPE study *Jason Needham*	Missouri River mainstem operations *Larry Murphy*	Res-Sim model for the Columbia River *Arun Mylvahanan*
Room 222	**TRACK 3 Section 227** Session 3G	Section 227 Workshop/ Program Review *William Curtis*	Section 227 Workshop/ Program Review (Continued) *William Curtis*	Section 227 Workshop/ Program Review (Continued) *William Curtis*	Break	**TRACK 3 Section 227** Session 3H	Section 227 Workshop/ Program Review *William Curtis*	Section 227 Workshop/ Program Review (Continued) *William Curtis*	Section 227 Workshop/ Program Review (Continued) *William Curtis*
Room 223	**TRACK 4 Modeling** Session 4G	Little Calumet River unsteady flow model conversion *Rick Ackerson*	Kansas City River basin model *Edward Parker*	Design guidance for breakup ice control *Andrew Tuthill*	Break	**TRACK 4 Modeling** Session 4H	Forebay flow simulations using Navier-Stokes code *Charlie Berger*	Use of regularizatino as a method for watershed model calibration *Brian Skahill*	Demonstration program in the arid southwest *Margaret Jonas*

Thursday, August 4, 2005 Concurrent Sessions

Geotechnical Track

Room	Track / Session	8:00 AM	8:30 AM	9:00 AM	9:30 AM	Track / Session	10:30 AM	11:00 AM	11:30 AM
Room 226	TRACK 5 Session 5E	Dynamic deformation analyses Dewey Dam Huntintong District Corps of Engineers *Greg Yankey*	Seismic stability evaluation for Ute Dam, NM *John France*	An overview of criteria used by various organizations for assessments and seismic remediation of earth dams *Sean Carter*	Break in Exhibit Hall	TRACK 5 Session 5F	USACE seepage berm design criteria and district practices *George Sills*	Ground penetrating radar applications for the assessment of airfield pavements *Lulu Edwards*	Challenges of the Fernando Belaunde Terry road upgrade Campanillia to Pizana - Peru road project *Michael Wielputz*
Room 227	TRACK 6 Session 6E	Small geotechnical project, big stability problem - The Block Church Road experience *Jonathan Kolber*	Geophysical investigation of foundation conditions beneath Folsom Dam *Jose Llopis*	Bioengineering slope stabilization techniques coupled with traditional engineering applications - The result a stable slope *Bethany Bearmore*	Break in Exhibit Hall	TRACK 6 Session 6F	Shoreline armor stone quality issues *Joseph Kissane*	Mill Creek - An urban flood control challenge *Monica Greenwell*	Next stop, The Twilight Zone *Troy O'Neal*
Room 228	TRACK 7 Session 7E	The geotechnical and structural issues impacting the Dalles spillway construction *Kristie Hartfeil*	The Dalles spillway engineering and design *Kristie Hartfeil*	The future of the discrete element method in infrastructure analysis *Raju Kala*	Break in Exhibit Hall	TRACK 7 Session 7F	Evaluating the portable falling weight deflectometer as a low-cost technique for posting seasonal load restrictions on low volume payments *Maureen Kestler*	Soil structure interaction effects in the seismic evaluation of success dam control tower *Michael Sharp*	Olmsted locks and Dam project geotechnical/construction issues *Jeff Schaefer*
Room 229	TRACK 8 Session 8E	Rubblization of airfield concrete pavement *Eileen Velez-Vega*	US Army airfield pavement assessment program *Haley Parsons*	Critical state for probabilistic analysis of levee underseepage *Douglas Crum*	Break in Exhibit Hall	TRACK 8 Session 8F	Curing practices for modern concrete construction *Toy Poole*	AAR at Carters Dam, a different approach *James Sanders*	Concrete damage at Carters Dam, GA *Toy Poole*

12 Noon **Lunch**

Room	Track / Session	1:30 PM	2:00 PM	2:30 PM	3:00 PM	Track / Session	3:30 PM	4:00 PM	4:30 PM
Room 226	TRACK 5 Session 5G	Slope stability evaluation of the Baldhill Dam right abutment *Neil Schwanz*	Lateral pile load test results within a soft cohesive foundation *Richard Varuso*	Design and construction of anchored bulheads for river diversion, Seabrook, NH *Siamac Vaghar*	Break	TRACK 5 Session 5H	Characterization of soft marine clays - A case study at Craney Island *Aaron Zdinak*	50 years of NRSC experience with engineering problems caused by dispersive clays *Danny McCook*	Changes in the post-tensioning institutes new (4th Ed. 2004) "Recommendations for prestressed rock and soil anchors" *Michael McCray*
Room 227	TRACK 6 Session 6G	Perils in back analysis failures *Greg Yankey*	Reconstruction of deteriorated lock walls concrete after blasting and other demolition removal techniques *Steve O'Connor*	Flood fighting structures demonstrations and evaluation program *George Sills*	Break	TRACK 6 Session 6H	Innovative design concepts incorporated into a landfill closure and reuse design *Dave Ray*	Laboratory testing of flood fighting structures *Johannes Wibowo*	Bluff stabilization along Lake Michigan using active and passive dewatering techniques *Eileen Glynn*
Room 228	TRACK 7 Session 7G	Geotechnical instrumentation and foundation reevaluation of John Day lock and Dam, Columbia River, Oregon-Washington *David Scofield*	A study of the long term performance of seepage cutoff barriers in dams *John Rice*	Design, construction, and performance of seepage barriers for Guanella Dam, near Empire, CO *John France*	Break	TRACK 7 Session 7H	Sensitive infrastructure sites and structures - Sonic drilling offers quality control and non-destructive advantages to geotechnical construction drilling *John Davis*	Subgrade failure criteria according to soil type and moisture condition *Edel Cortez*	The automated stability monitoring of the Mississippi River levees using the range scan system *Robert Jolissian*
Room 229	TRACK 8 Session 8G	Damaging interactions among concrete materials *Toy Poole*	Economic effects on construction of uncertainty in test methods *Toy Poole*	Major issues in materials specifications *Toy Poole*	Break	TRACK 8 Session 8H	Spall and intermediate-sized repairs for PCC pavements *Reed Freeman*	Acceptance criteria for unbonded aggregate road surfacing materials *Reed Freeman*	Effective partnering to overcome an interruption in the supply of Portland cement during construction of Marmet lock and Dam *Billy Neeley*

Thursday, August 4, 2005 Concurrent Sessions

Geotechnical, Specifications, Electrical & Mechanical Engineering & Construction Tracks

Room	Track	8:00 AM	8:30 AM	9:00 AM	9:30 AM	Track	10:30 AM	11:00 AM	11:30 AM
Room 225	**TRACK 9** Geotechnical — Session 9E	Seepage Committee Meeting — *GROUP DISCUSSION*	Seepage Committee Meeting (Continued) — *GROUP DISCUSSION*	Seepage Committee Meeting (Continued) — *GROUP DISCUSSION*	Break in Exhibit Hall	**TRACK 9** Geotechnical — Session 9F	GMCoP Forum — *GROUP DISCUSSION*	GMCoP Forum (Continued) — *GROUP DISCUSSION*	GMCoP Forum (Continued) — *GROUP DISCUSSION*
Room 232	**TRACK 21** Specifications — Session 21E	SpecsIntact-Demonstration of the SI explorer, publishing to PDF and Word — *Patricia Robinson*	SpecsIntact - Demonstration of the SI editor, UMRL and reference wizard — *Patricia Robinson*	UFGS status and direction — *Jim Quinn*	Break in Exhibit Hall	**TRACK 21** Specifica-tions — Session 21F	UFGS transitin to Master-Format 2004 — *Carl Kersten*	Project specifications for the upper tier Folsom outlet works modifications — *Steve Freitas*	UFGS dredging — *Don Carmen*
Room A	**TRACK 15** Military Electrical — Session 15E	Electronic Security — *Tri-Service Panel*	Electronic Security (Continued) — *Tri-Service Panel*	AIRFIELD lightning protection & grounding and lighting — *Tri-Service Panel*	Break in Exhibit Hall	**TRACK 15** Military Electrical — Session 15F	Electrical safety and arc flash UFC — *Tri-Service Panel*	Electrical safety and arc flash UFC (Continued) — *Tri-Service Panel*	Electrical infrastructure in Iraq - Restore Iraqi electricity — *Joseph Swiniarski*
Room B	**TRACK 16** Military Mechanical — Session 16E	Lon works technology update — *David Schwenk*	BACnet Technology Update — *David Schwenk*	Implementation of Lon-based specifications — *Will White*	Break in Exhibit Hall	**TRACK 16** Military Mechanical — Session 16F	Prefabricated Chiller Plants — *Trey Austin*	Seismic for ME systems — *Greg Stutts*	Design considerations for the prevention of mold — *Quinn Hart*
Room D	**TRACK 17** Civil Mechanical — Session 17E	Lessons learned on flood water pump stations — *Mark Robertson*	Armada of pump stations, Grand Forks and East Grand Forks — *Timothy Paulus*	Various screen equipment selection guide — *Sara Benier*	Break in Exhibit Hall	**TRACK 17** Civil Mechanical — Session 17F	Lock gate replacement system — *Will Smith*	Lock gate replacement system (Continued) — *Will Smith*	Automated closure gate design for Duck creek flood control — *Mark Robertson*
Room 230	**TRACK 19** Construction — Session 19E	NAVFAC Construction scheduling — *Glenn Saito*	NAVFAC Construction scheduling (Continued) — *Glenn Saito*	ACASS/CASS - CPARS — *Ed Marceau*	Break in Exhibit Hall	**TRACK 19** Construction — Session 19F	Self-consolidating concrete — *Beatrix Kerhoff*	Self-consolidating concrete (Continued) — *Beatrix Kerhoff*	
Room 231	**TRACK 20** Construction — Session 20E	Update on DAWIA and Facilities Engineering — *Mark Grammer*	Update on DAWIA and Facilities Engineering (Continued) — *Mark Grammer*	Partnering as a best practice — *Ray DuPont*	Break in Exhibit Hall	**TRACK 20** Construction — Session 20F	S&A Update — *Harry Jones*	Construction Issues Open Forum (Q&A) — *Don Basham*	Construction Issues Open Forum (Q&A) (Continued) — *Don Basham*

12 Noon — **Lunch**

Room	Track	1:30 PM	2:00 PM	2:30 PM	3:00 PM	3:30 PM	4:00 PM	4:30 PM
Room 225	**TRACK 9** Geotechnical — Session 9G	Seismic Manual — *GROUP DISCUSSION*	Seismic Manual (Continued) — *GROUP DISCUSSION*	Seismic Manual (Continued) — *GROUP DISCUSSION*				

Thursday, August 4, 2005 Concurrent Sessions

Dam Safety Track & Structural Engineering Track

Room	Track / Session	8:00 AM	8:30 AM	9:00 AM	9:30 AM	Track / Session	10:30 AM	11:00 AM	11:30 AM
Room 224	**TRACK 10** Dam Safety **Session 10E**	Seepage and stability, final evaluation for reservoir pool raising project, Terminus Dam, Kaweah River, CA *Michael Ramsbotham*	Initial filling plan, Terminus dam spillway enlargement, Terminus Dam, Kaweah River, CA *Michael Ramsbotham*	Hydrologic aspects of operating in a "failure mode" - Fern Ridge Lake, OR *Bruce Duffe*	Break in Exhibit Hall	**TRACK 10** Dam Safety **Session 10F**	A dam safety study involving cascading dam failures *Gordon Lance*		The relationship of seismic velocity to the erodibility index *Joseph Topi*
Room 240	**TRACK 12** Civil Works Structural **Session 12E**	London lock and dam, West Virginia major rehabilitation project *David Sullivan*	Replacing existing lock 4-Innovative designs for Charleroi lock *Steveb Stoltz*	Use of non-linear incremental structural analysis in the design of the Charleroi lock *Randy James*	Break in Exhibit Hall	**TRACK 12** Civil Works Structural **Session 12F**	Olmsted dam in-the-wet construction methods *Lynn Raque*	Completion of the Olmstead approach walls *Terry Sullivan*	John Day lock monolith repair *Mathew Hanson*
Room 241	**TRACK 13** Civil Works Structural **Session 13E**	Chicago shoreline project *Jan Plachta*	Structural assessment of Bluestone Dam *Robert Reed*	Duck Creek, OH local flood protection projection phase III Culvert damage *Jeremy Nichols*	Break in Exhibit Hall	**TRACK 13** Civil Works Structural **Session 13F**	Development of design criteria for the Rio Puerto Nuevo contract 2D/2E channel wall *Jana Tanner*	Design of concrete lined tunnels in rock *David Force*	Indianapolis north phase IIIA project *Gene Hoard*
Room 242	**TRACK 14** Bridges/ Buildings **Session 14E**	Urban search & rescue program overview *Tom Niedernhofer*	Evaluation and repair of blast damaged reinforced concrete beams *John Hudson*	Single degree of freedom blast effects spreadsheets *Dale Nebuda*	Break in Exhibit Hall	**TRACK 14** Bridges/ Buildings **Session 14F**	UFC 4-023-02 Structural design to resist explosive effects for existing buildings *Jim Caulder*	Progressive collapse UFC requirements *Brian Crowder*	U.S. general services admnistrative progressive collapse design guidelines applied to concrete moment-resisting frame buildings *David Billow*

12 Noon **Lunch**

Room	Track / Session	1:30 PM	2:00 PM	2:30 PM	3:00 PM	Track / Session	3:30 PM	4:00 PM	4:30 PM
Room 224	**TRACK 10** Dam Safety **Session 10G**	Dam safety instrumentation data management utilizing WinIDP to aid data collection and evaluation *Travis Tutka*	Automated instrumentation assessments at Marmet lock & Dam *Ronald Rakes*	Potential failure mode analysis of Eau Galle Dam *David Rydeen*	Break	**TRACK 10** Dam Safety **Session 10H**	Dam safety officers panel - The Good *Bruce Murray*	Dam safety officers panel - The Bad *Bruce Murray*	Dam safety officers panel - The Ugly *Bruce Murray*
Room 240	**TRACK 12** Civil Works Structural **Session 12G**	Inner Harbor navigation canal and lock structure *Mark Gonski*	Design features and challenges of the Comite River diversion project *Christopher Dunn*	Waterline support failure on the Harvey canal: A case study *Angela DeSoto Duncan*	Break	**TRACK 12** Civil Works Structural **Session 12H**	Public appeal of major civil projects- The good, the bad and the ugly *Kevin Holden*	Des Moines Riverwalk *Thomas Heinold*	Chickamauga lock and Dam height optimization study using Monte Carlo simulation *Leon Schieber*

Thursday, August 4, 2005 Concurrent Workshops

Room	Workshop	1:30 PM	2:00 PM	2:30 PM	3:00 PM	Workshop	3:30 PM	4:00 PM	4:30 PM
Room 241	**Workshop 1** DoD Security Engineering — **Session 1A**	Security planning & minimum standards *Curt Betts*	Security planning & minimum standards (Continued) *Curt Betts*	Security planning & minimum standards (Continued) *Curt Betts*	Break	**Workshop 1** DoD Security Engineering — **Session 1B**	Security design manuals *Bernie Deneke*	Security design manuals (Continued) *Bernie Deneke*	Security design manuals (Continued) *Bernie Deneke*
Room 231	**Workshop 2** Electrical Workshop — **Session 2A**	National Electrical Code 2005 Changes *Mark McNamara*	National Electrical Code 2005 Changes (Continued) *Mark McNamara*	National Electrical Code 2005 Changes (Continued) *Mark McNamara*	Break	**Workshop 2** Electrical Workshop — **Session 2B**	National Electrical Code 2005 Changes (Continued) *Mark McNamara*	National Electrical Code 2005 Changes (Continued) *Mark McNamara*	National Electrical Code 2005 Changes (Continued) *Mark McNamara*
Room 242	**Workshop 3** Mechanical Engineering — **Session 3A**	Design and application of packaged central cooling plants *The Trane Company*	Design and application of packaged central cooling plants (Continued) *The Trane Company*	Design and application of packaged central cooling plants (Continued) *The Trane Company*	Break	**Workshop 3** Mechanical Engineering — **Session 3B**	Improving dehumidification in HVAC systems *The Trane Company*	Improving dehumidification in HVAC systems (Continued) *The Trane Company*	Improving dehumidification in HVAC systems (Continued) *The Trane Company*
Room 230	**Workshop 4** Construction — **Session 4A**	Construction Community of Practice Forum *Walt Norko*	Construction Community of Practice Forum (Continued) *Walt Norko*	Construction Community of Practice Forum (Continued) *Walt Norko*	Break				
Room 232	**Workshop 5** Specifications — **Session 5A**	Open Meeting of Corps Specifications Steering Committee *Robert Iseli, et al.*	Open Meeting of Corps Specifications Steering Committee (Continued) *Robert Iseli, et al.*	Open Meeting of Corps Specifications Steering Committee (Continued) *Robert Iseli, et al.*	Break	**Workshop 5** Specifications — **Session 5B**	Open Meeting of Corps Specifications Steering Committee (Continued) *Robert Iseli, et al.*	Open Meeting of Corps Specifications Steering Committee (Continued) *Robert Iseli, et al.*	Open Meeting of Corps Specifications Steering Committee (Continued) *Robert Iseli, et al.*

NOTES

NDIA
NATIONAL DEFENSE INDUSTRIAL ASSOCIATION
STRENGTH THROUGH INDUSTRY & TECHNOLOGY

2005 Tri-Service Infrastructure Systems Conference & Exhibition
"Re-Energizing Engineering Excellence"
August 2-4, 2005
St. Louis, MO

Design, Construction and Seepage at Prado Dam

Douglas E. Chitwood, P.E., G.E.
Embankment Engineer, Prado Dam

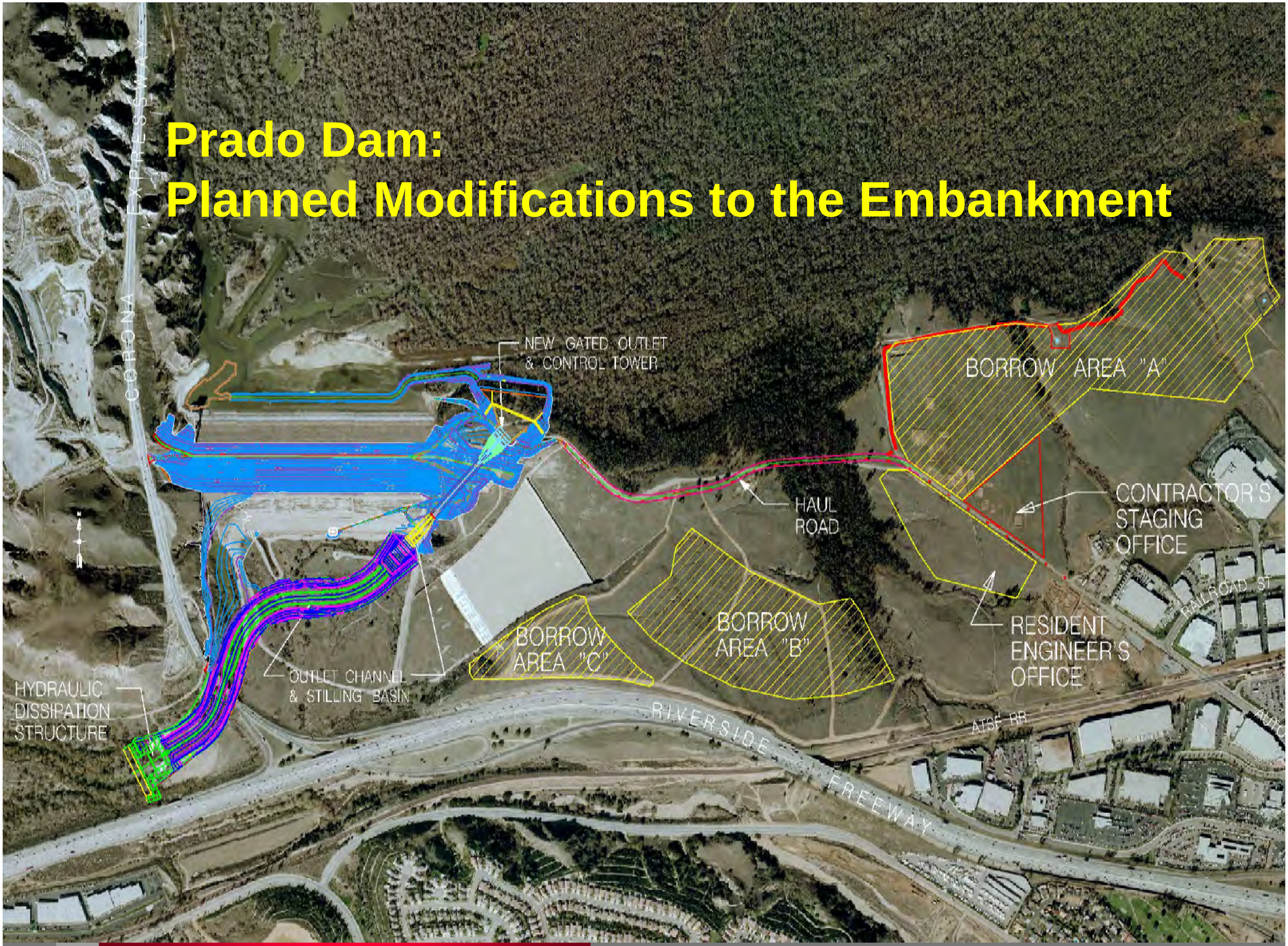
SANTA ANA RIVER MAINSTEM PROJECT
PROJECT MAP

SAR Mainstem

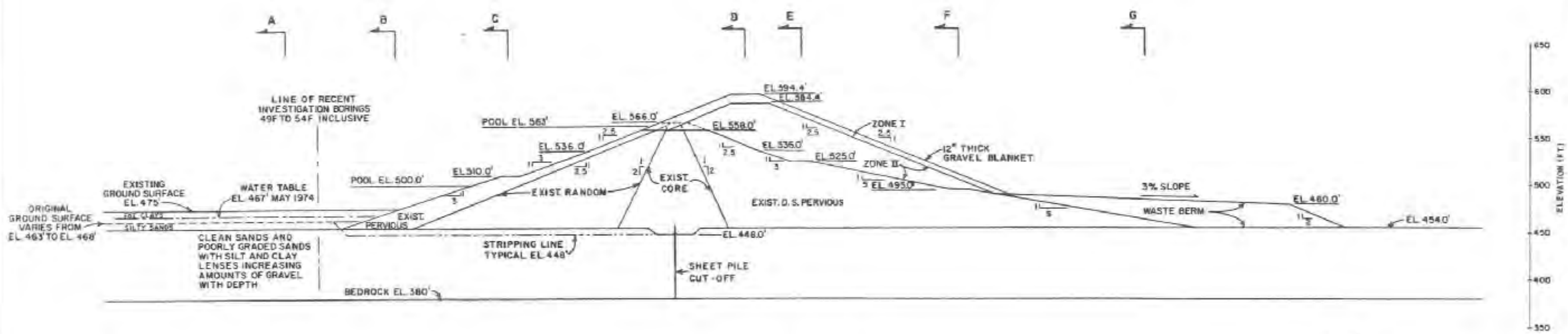
Prado Dam

(after Modifications)

Prado Dam:
Planned Modifications to the Embankment



Original Embankment: Typical Section



SCALE FT
0 25 50 100

NOTE

FOR PURPOSES OF ANALYSIS THE WATER TABLE WAS ASSUMED TO BE AT THE EXISTING GROUND SURFACE

TYPICAL SECTION

COMPACTION DATA
EXISTING EMBANKMENT

MATERIAL TYPE	COMPACTIVE EFFORT ON 6 INCH LIFTS NO. OF PASSES	EQUIPMENT TYPE	AVG. DRY DENSITY (PCF)	AVG. MOISTURE (PERCENT)
U. S. PERVIOUS	4-6	DRUM ROLLER	130.1	9.3
RANDOM	8	SHEEPSFOOT ROLLER	124.5	10.9
CORE	8	SHEEPSFOOT ROLLER	118.6	12.9
D. S. PERVIOUS	4-6	DRUM ROLLER	127.4	9.8

DATUM IS NATIONAL GEODETIC VERTICAL DATUM OF 1929

REVISIONS

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

SANTA ANA RIVER BASIN, CALIFORNIA
PHASE II GENERAL DESIGN MEMORANDUM

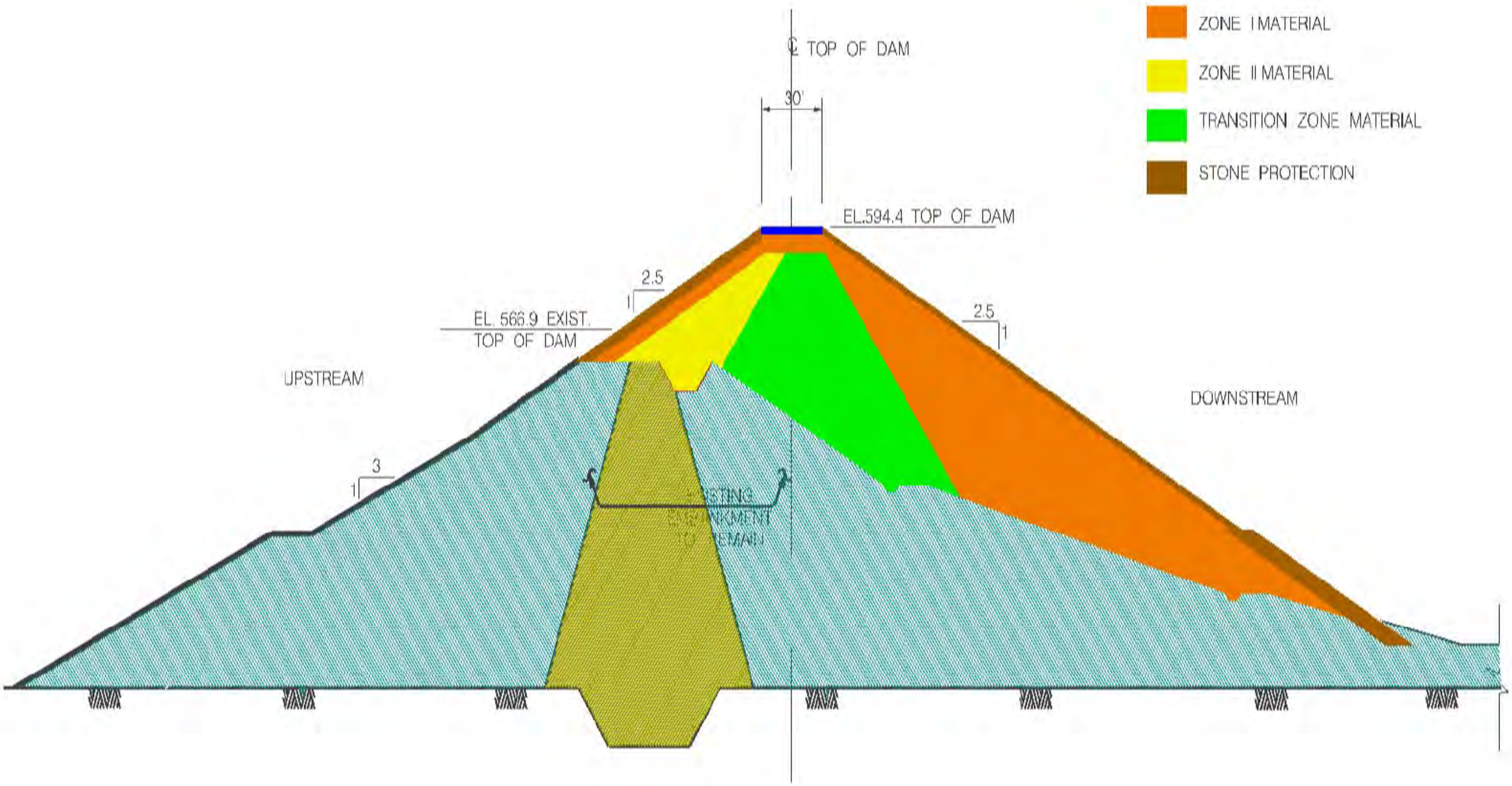
PRADO DAM

TYPICAL EMBANKMENT SECTION

SPEC. NO. DACW09-___ B-___

DISTRICT FILE NO.

Typical Dam Section



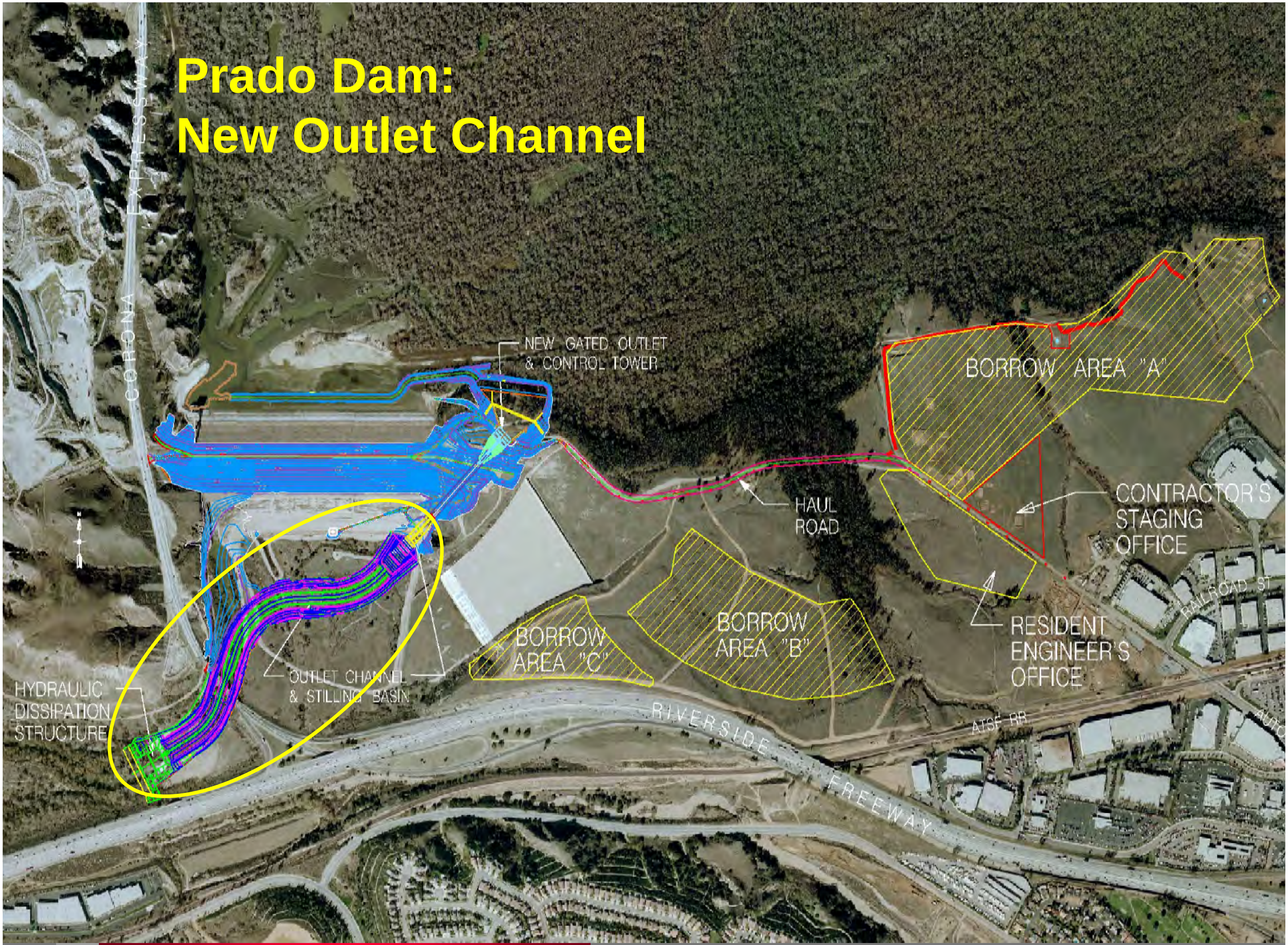

Zoned Embankment


2004 5 19

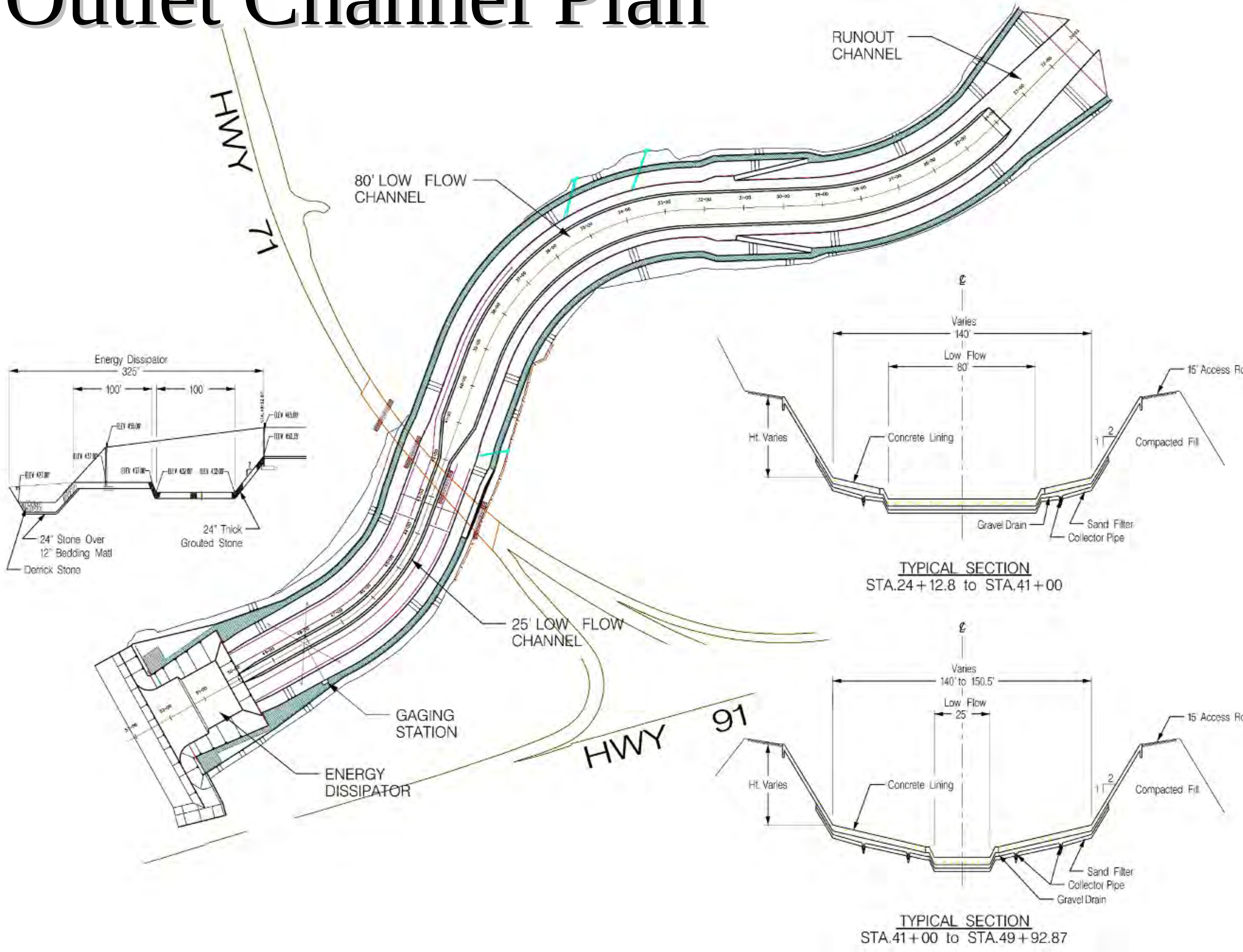

2004 5 24


2004 12 17

Prado Dam:
New Outlet Channel



Outlet Channel Plan



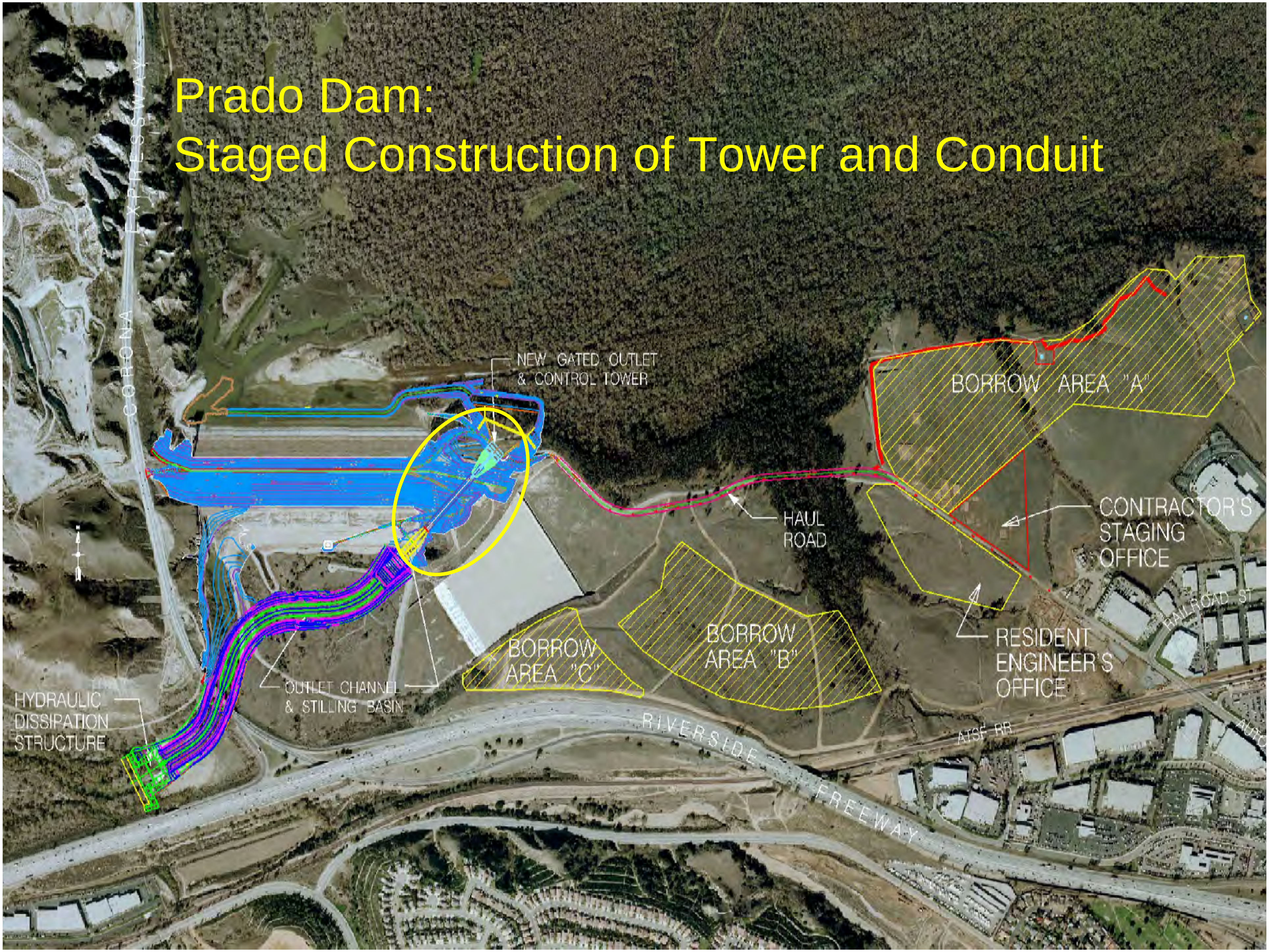

2004 8 18


AUG 23 2004

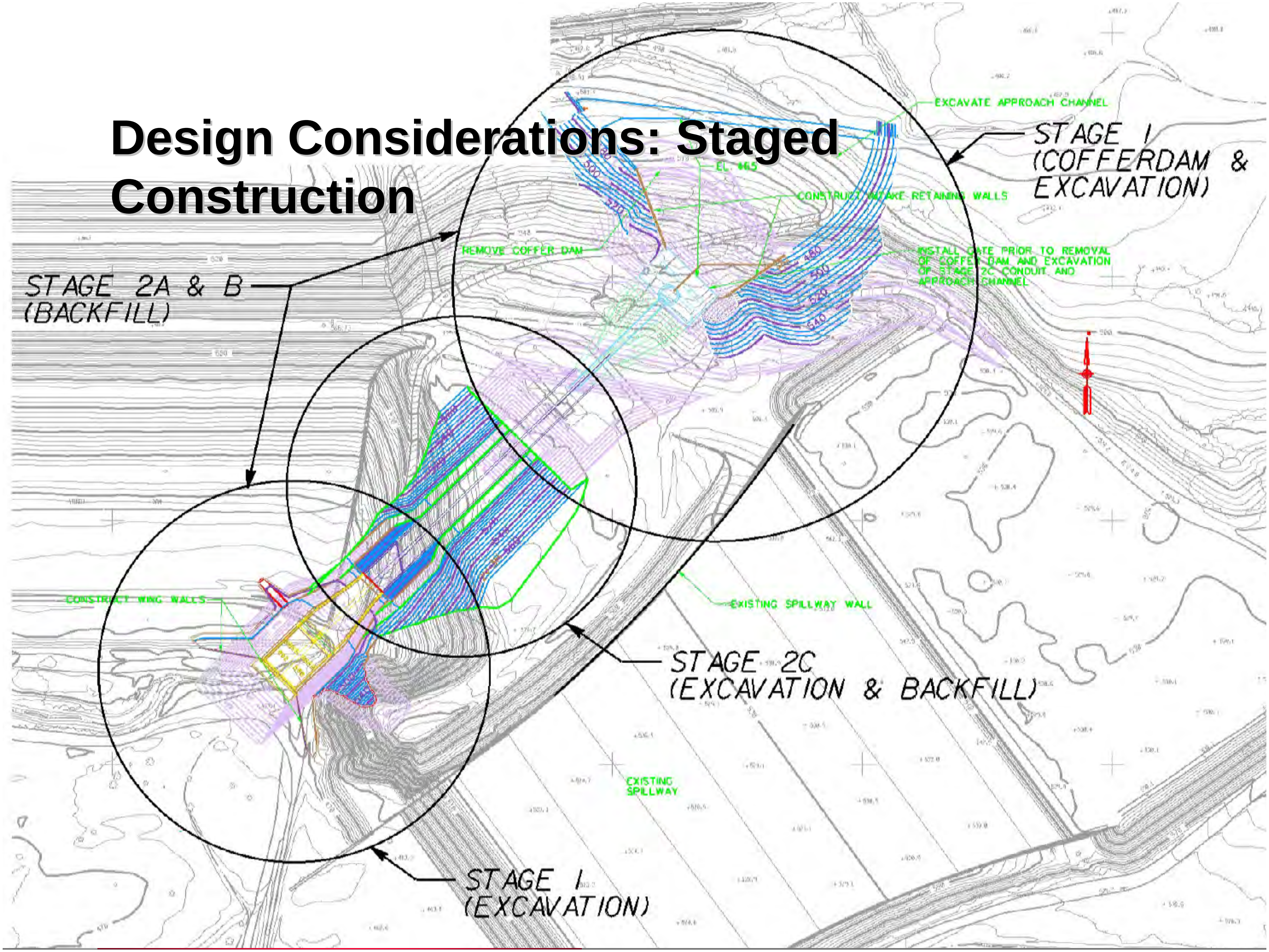

25 10:44 AM

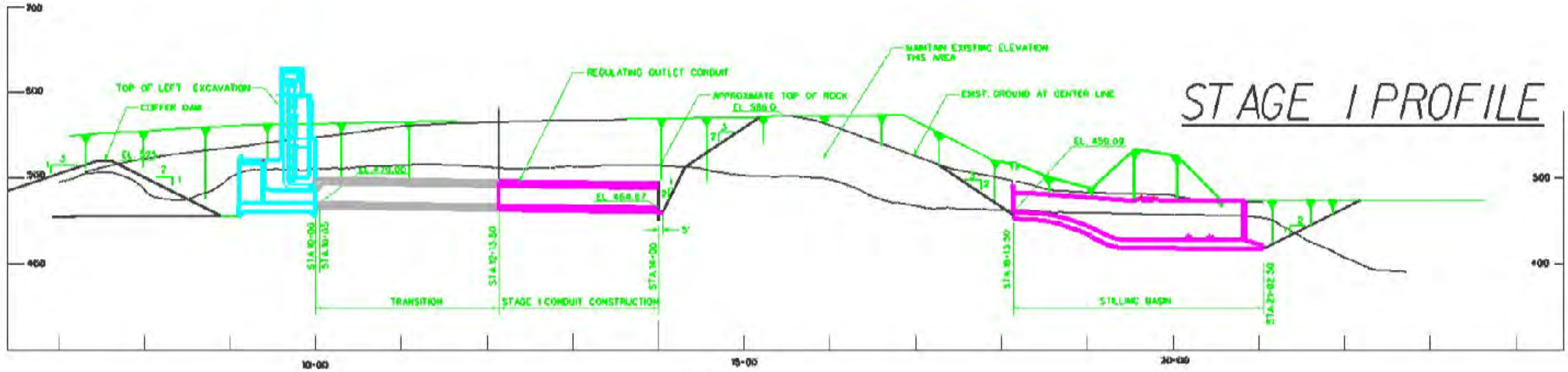

2005 4 28

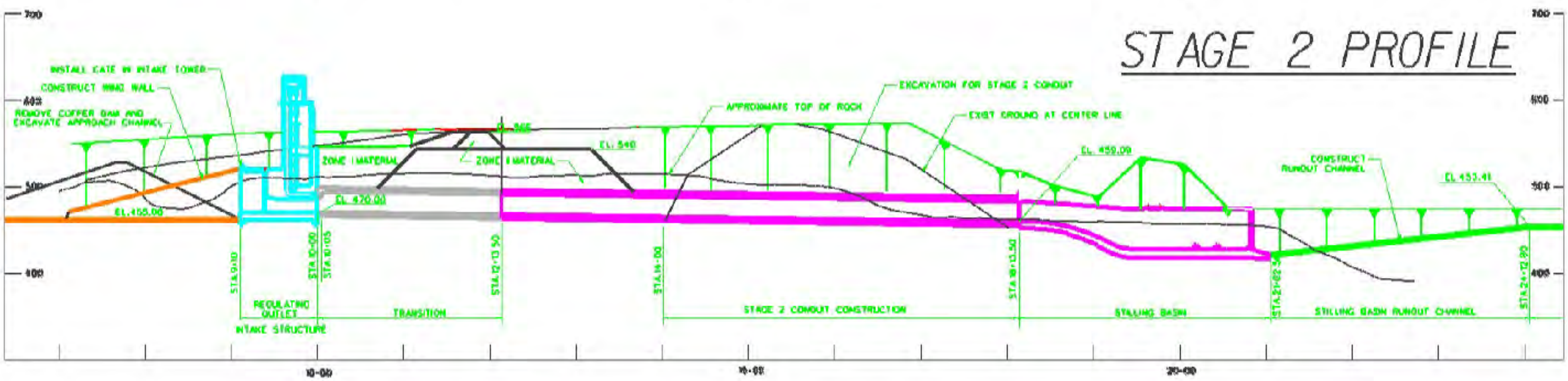
Prado Dam:
Staged Construction of Tower and Conduit

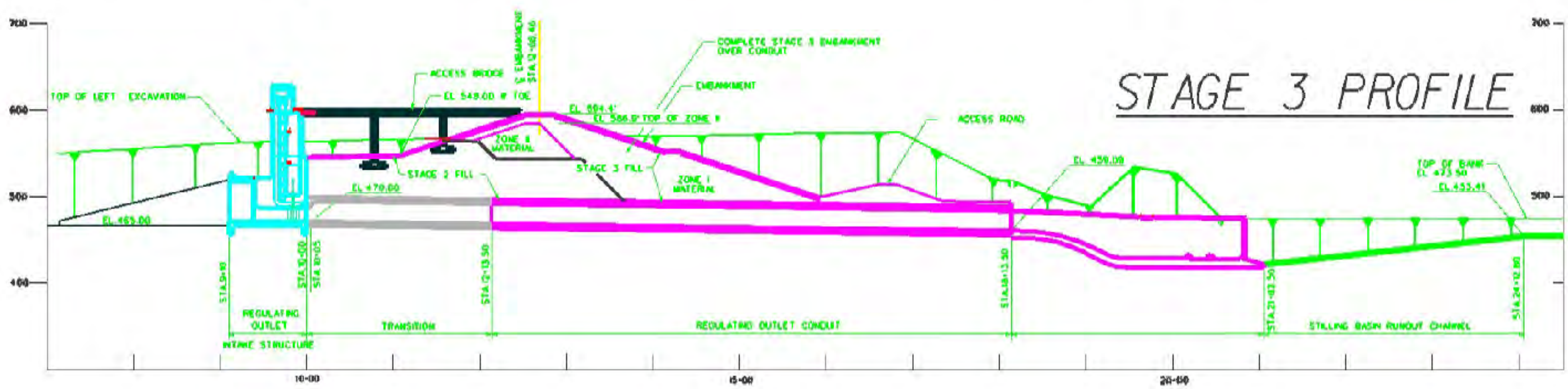


Design Considerations: Staged Construction

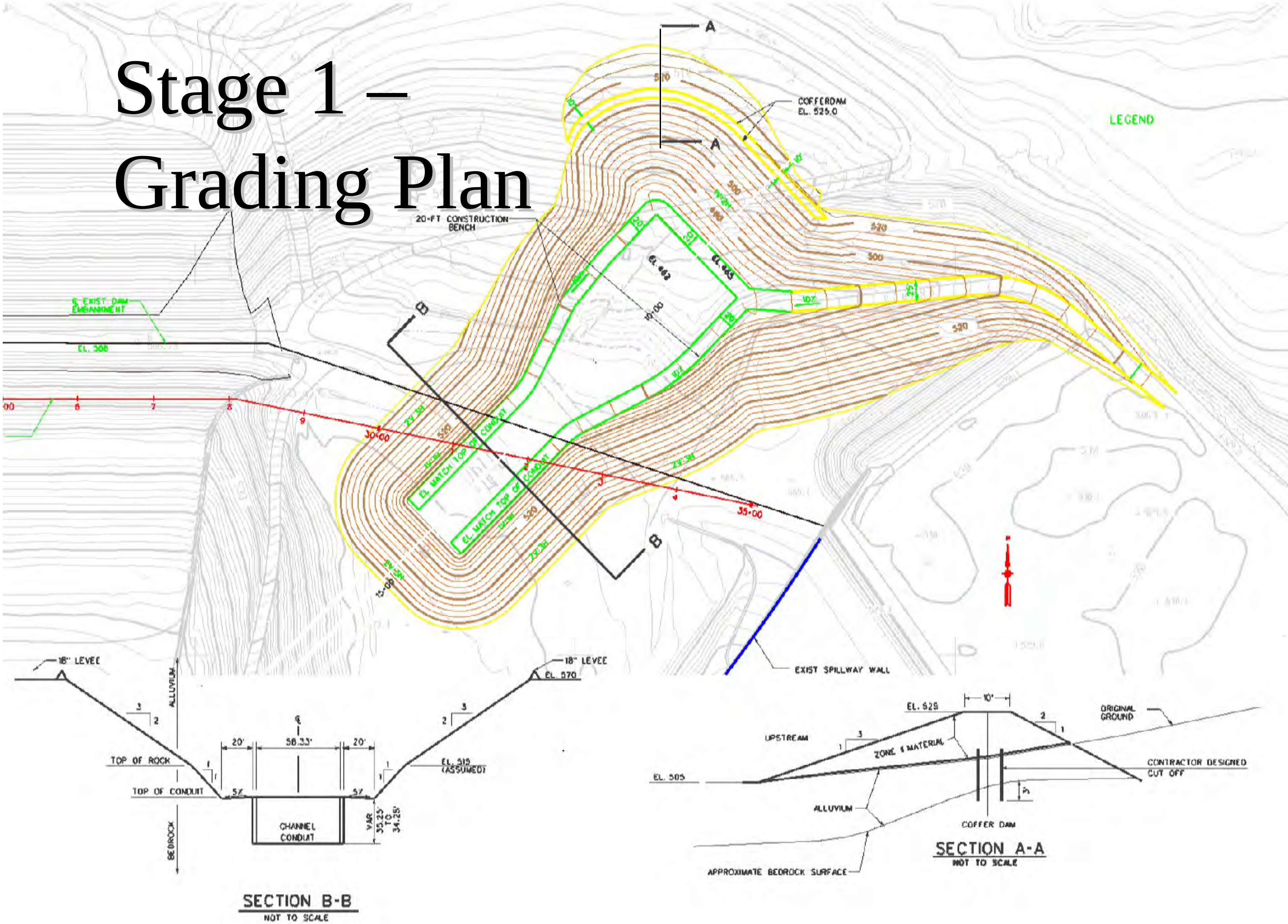



STAGE 1 PROFILE
TOP OF LEFT EXCAVATION
COFFER DAM
REGULATING OUTLET CONDUIT
APPROXIMATE TOP OF ROCK
EL 586.0
MAINTAIN EXISTING ELEVATION THIS AREA
EXIST. GROUND AT CENTER LINE
EL 470.00
EL 468.87
EL 459.09
TRANSITION
STAGE 1 CONDUIT CONSTRUCTION
STILLING BASIN
10+00
15+00
20+00


STAGE 2 PROFILE
INSTALL GATE IN INTAKE TOWER
CONSTRUCT WING WALL
REMOVE COFFER DAM AND EXCAVATE APPROACH CHANNEL
EL 465.00
ZONE I MATERIAL
EL 540
APPROXIMATE TOP OF ROCK
EXCAVATION FOR STAGE 2 CONDUIT
EXIST GROUND AT CENTER LINE
EL 470.00
EL 459.09
CONSTRUCT RUNOUT CHANNEL
EL 453.41
REGULATING OUTLET
INTAKE STRUCTURE
TRANSITION
STAGE 2 CONDUIT CONSTRUCTION
STILLING BASIN
STILLING BASIN RUNOUT CHANNEL
10+00
15+00
20+00


STAGE 3 PROFILE
TOP OF LEFT EXCAVATION
ACCESS BRIDGE
EL 549.00 @ TOE
COMPLETE STAGE 3 EMBANKMENT OVER CONDUIT
EMBANKMENT
ACCESS ROAD
STAGE 2 FILL
STAGE 3 FILL
ZONE I MATERIAL
EL 465.00
EL 470.00
EL 459.09
TOP OF BANK
EL 453.41
REGULATING OUTLET
INTAKE STRUCTURE
TRANSITION
REGULATING OUTLET CONDUIT
STILLING BASIN RUNOUT CHANNEL
10+00
15+00
20+00

Stage 1 – Grading Plan



Stage 1 Excavation

Stage 1 Excavation

Cofferdam


Cofferdam 2
Cofferdam 1
2005 2 22

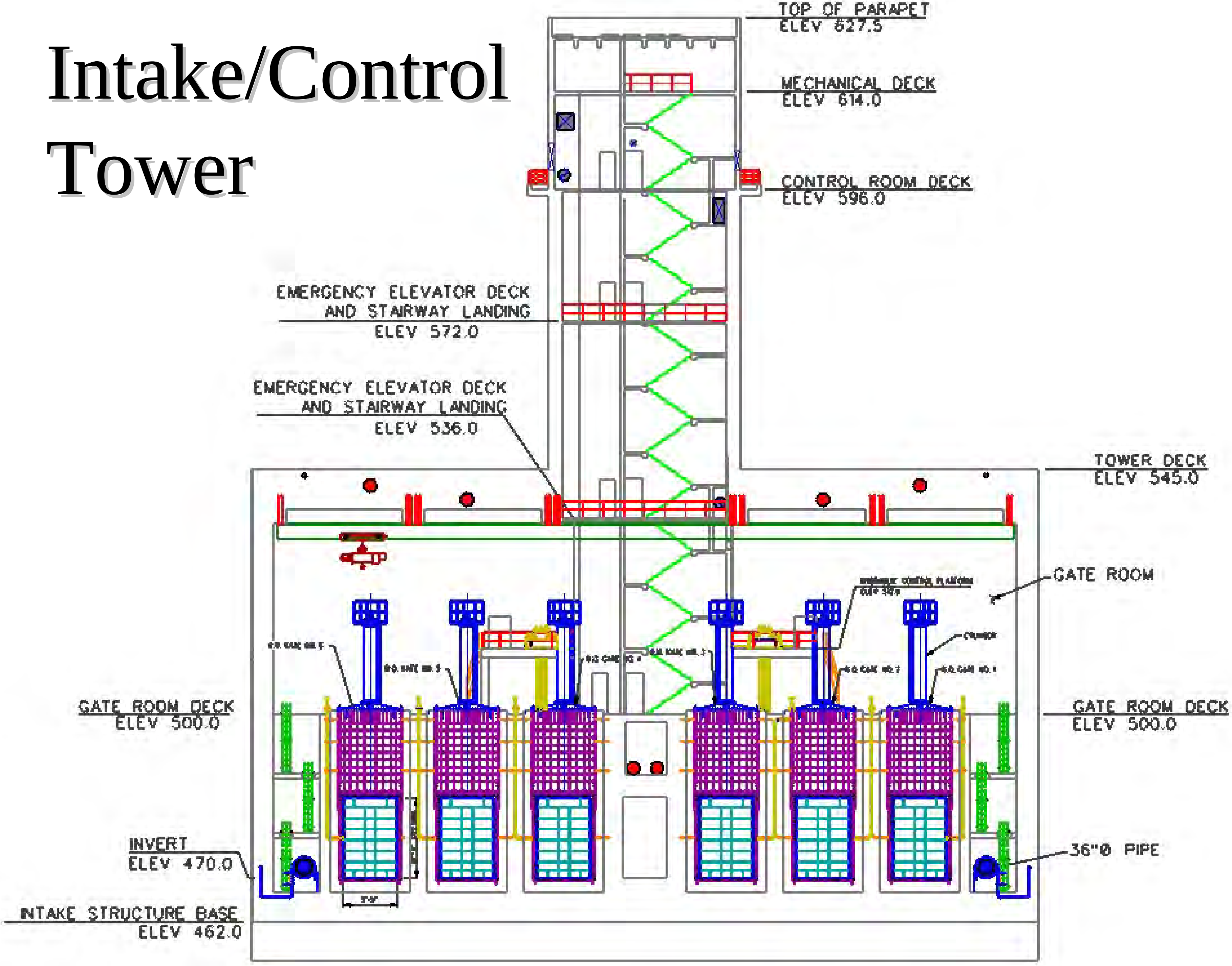

2003 8 5


2003 8 11


2003 8 18

Cofferdam II – Miscellaneous Fill with Visqueen Liner

Intake/Control Tower




2004 10 1


DEC 10 2004


2004 7 29


2004 12 13

Received Thursday, 6 January 05

From the National Weather Service...

DISCUSSION:

.TODAY...NO PRECIP EXPECTED.

.FRIDAY...AND CONTINUING ALL THE WAY INTO TUESDAY OF NEXT WEEK...

AN EXTREMELY WET WEATHER PATTERN WILL IMPACT SOUTHERN CALIFORNIA.

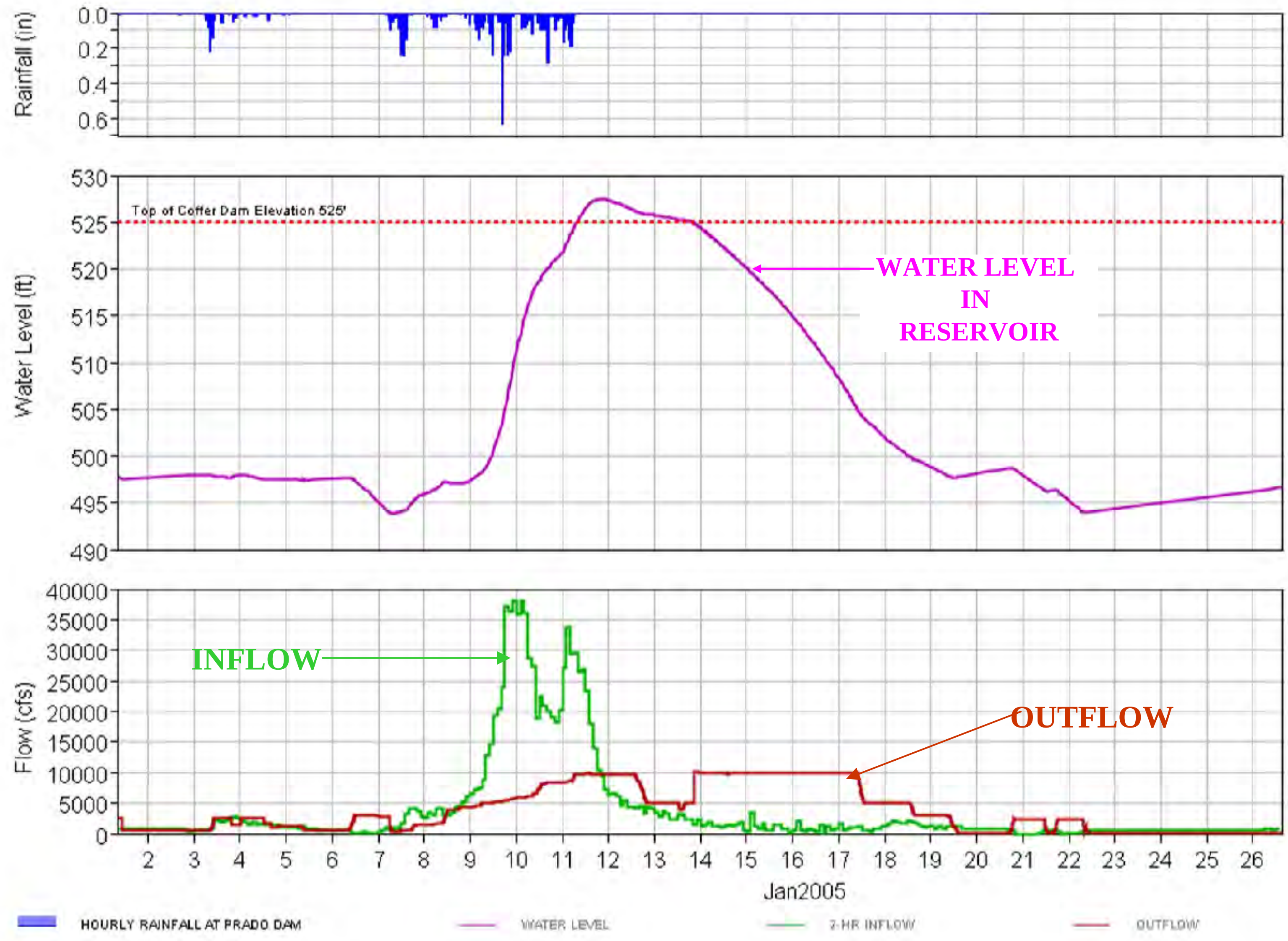
A TROPICAL PLUME KNOWN AS THE PINEAPPLE EXPRESS WILL BE FEEDING

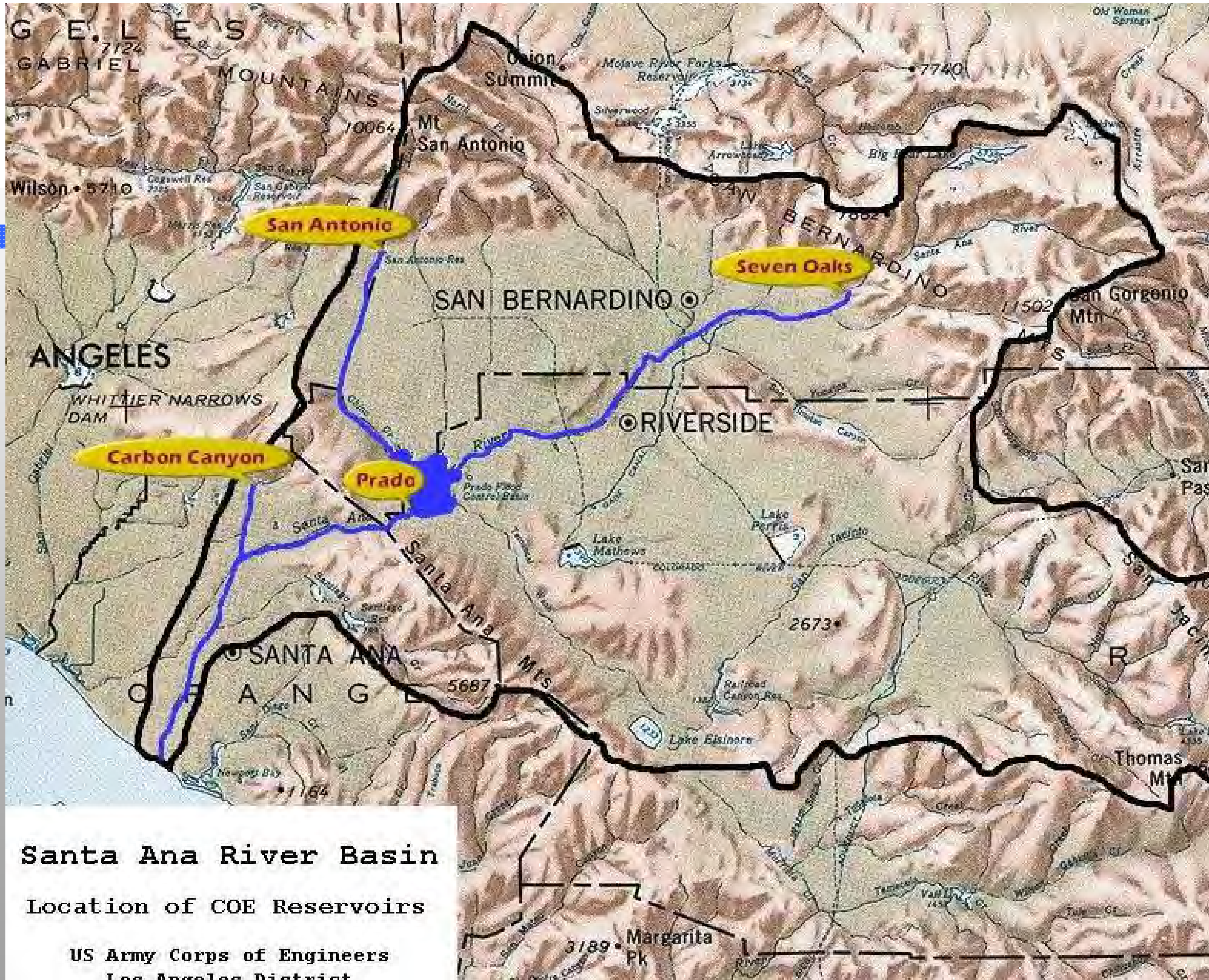
MOISTURE INTO A SERIES OF PACIFIC STORMS. HEAVY RAINS WILL CAUSE

URBAN FLOODING AND MOUNTAIN MUDSLIDES. SOME RIVERS WILL BE SUSCEPTIBLE TO OVERFLOW. **THIS WEATHER PATTERN LOOKS SIMILAR TO THE ONE THAT PRODUCED THE FLOODS IN THE YEAR 1969.** 50KT WARM MOIST SW WINDS FROM 5000 TO 10000 FEET ENSURES THAT ALL SOUTH AND WEST FACING MOUNTAIN SLOPES WILL GET HUGE STORM TOTALS FOR THE 5 DAY PERIOD ENDING TUESDAY.

Prado Dam Operation

Jan 1-25, 2005





Santa Ana River Basin

Location of COE Reservoirs

US Army Corps of Engineers
Los Angeles District


JAN 10 2005


JAN 11 2005


JAN 11 2005

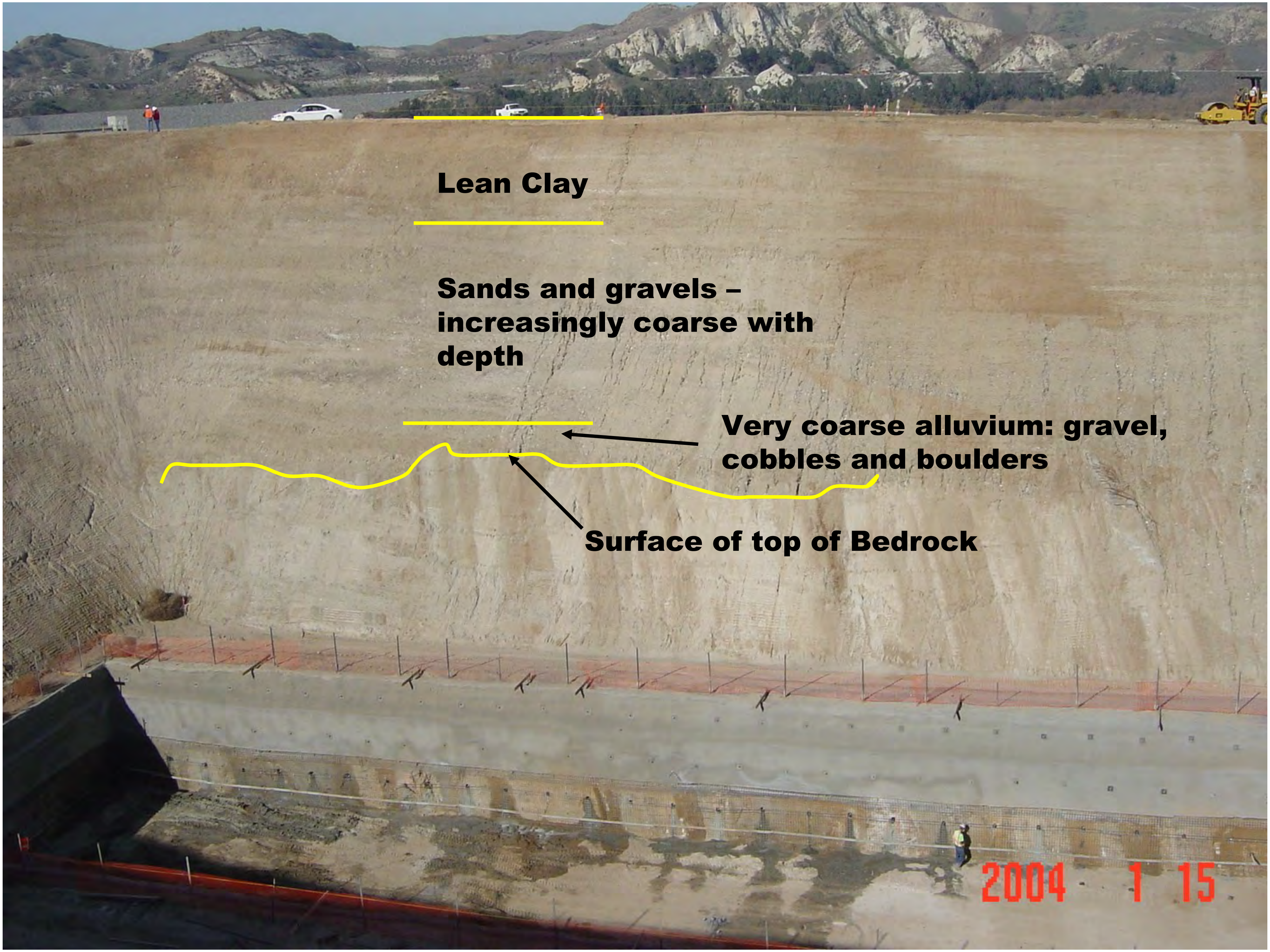

2005 1 11


JAN 11 2005


2005 1 11


2005 5 23


2005 1 12


Lean Clay
Sands and gravels – increasingly coarse with depth
Very coarse alluvium: gravel, cobbles and boulders
Surface of top of Bedrock
2004 1 15

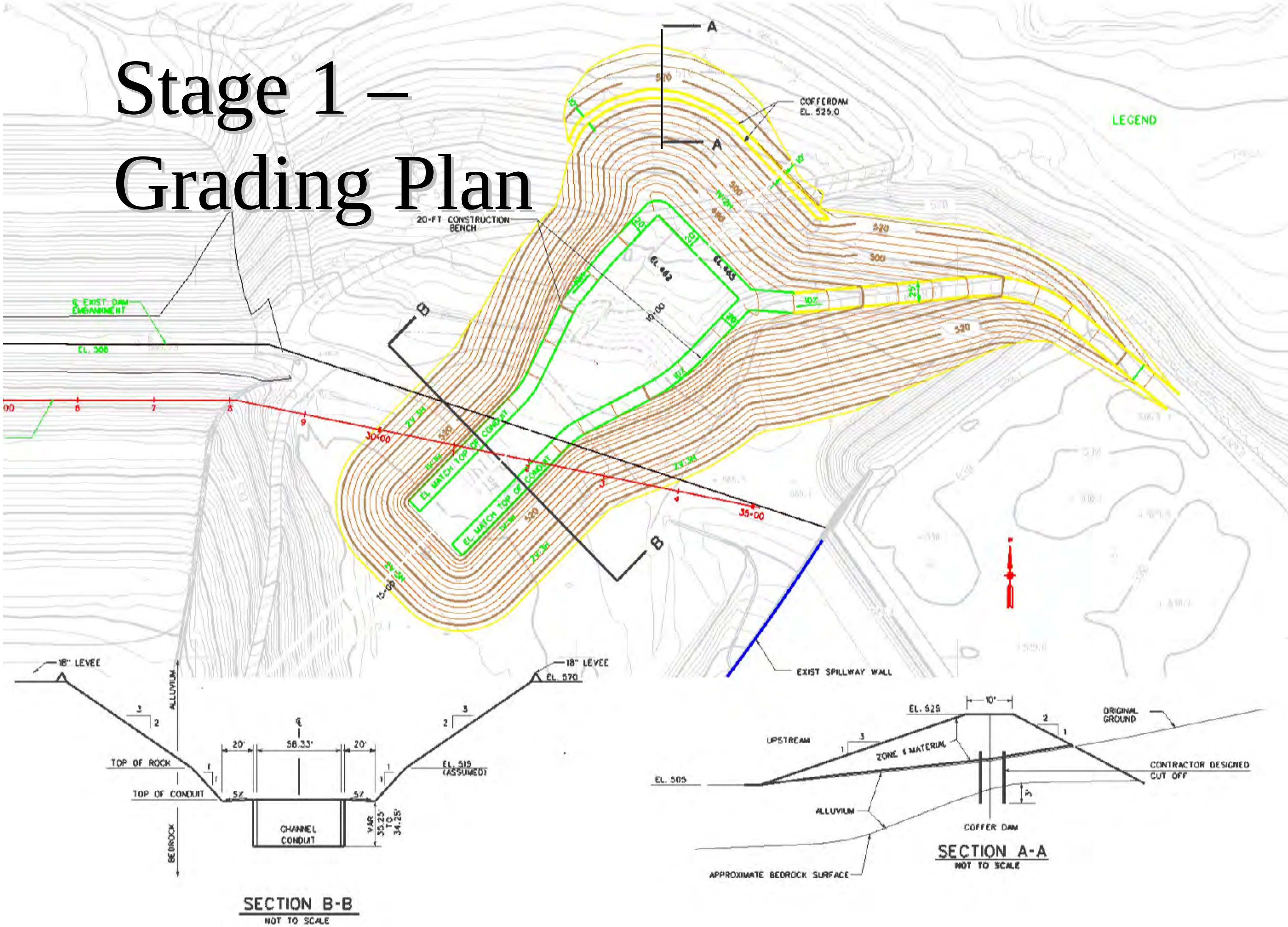

2005 1 19


2005 1 19

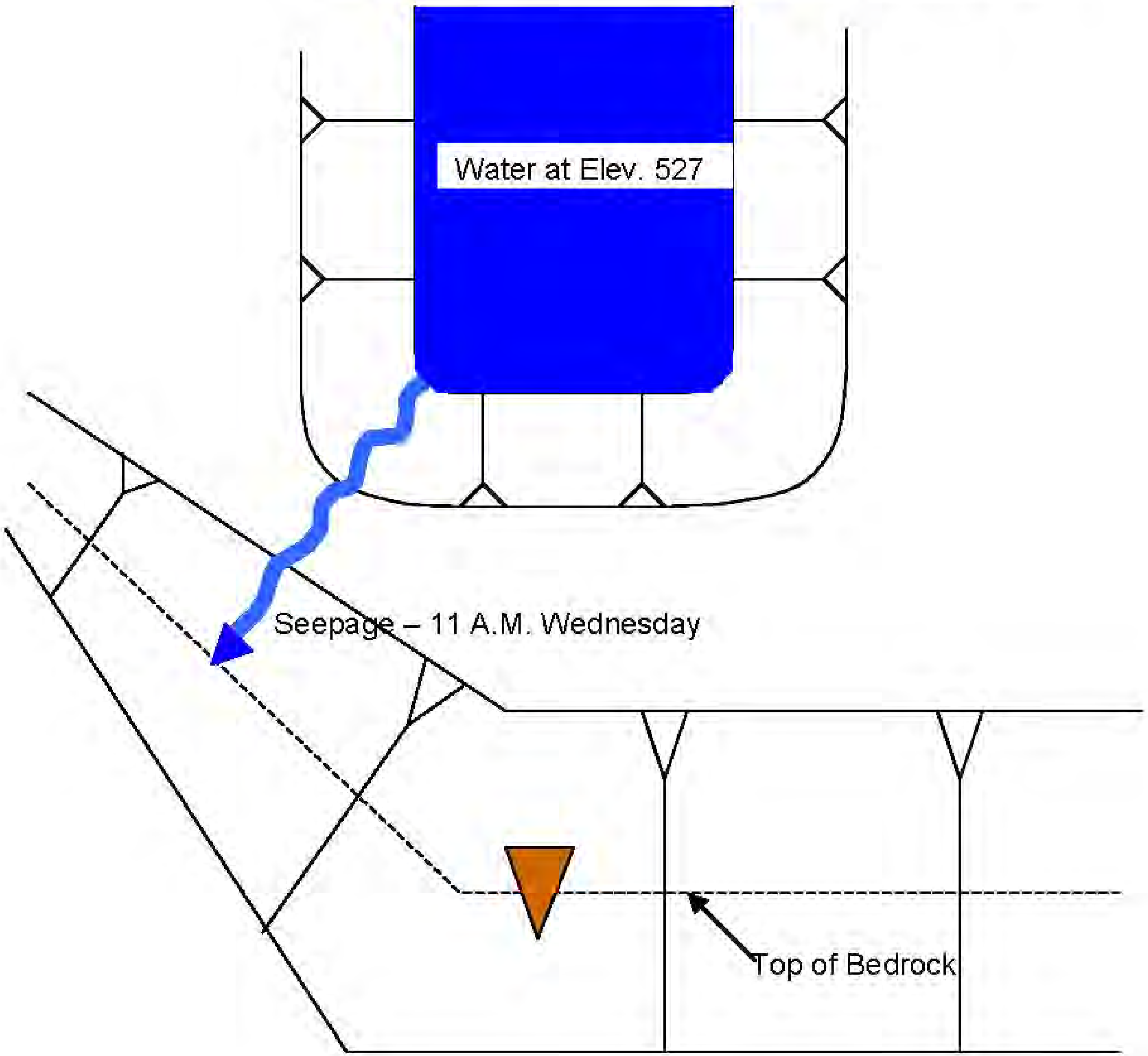
A stability analysis was conducted by the Los Angeles District Geotechnical Group on the "Thin Section" in December 2003. Among other things, the reported concluded:

"Catastrophic failure due to seepage will not occur as gradient would be much less than critical"

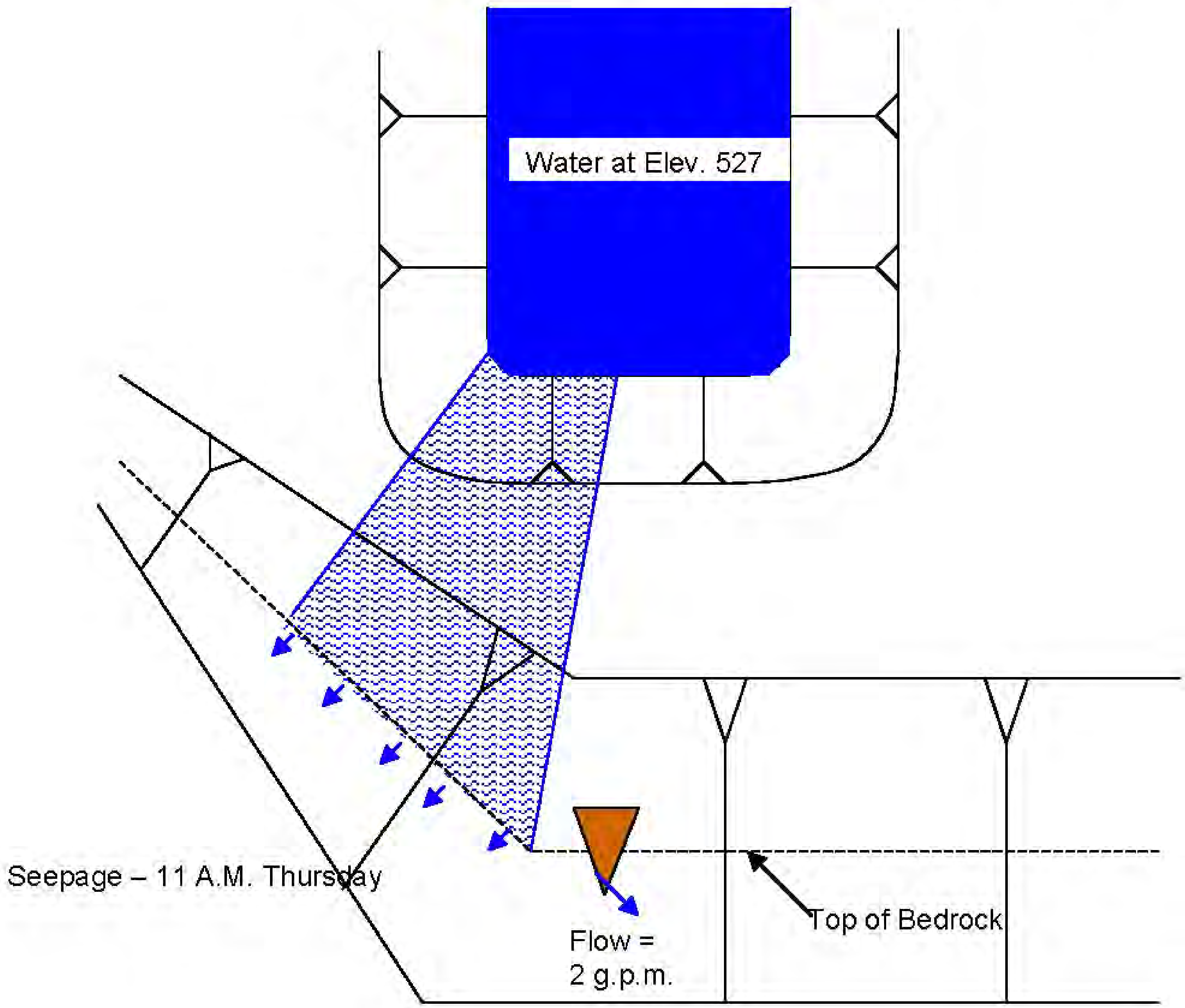
Stage 1 – Grading Plan



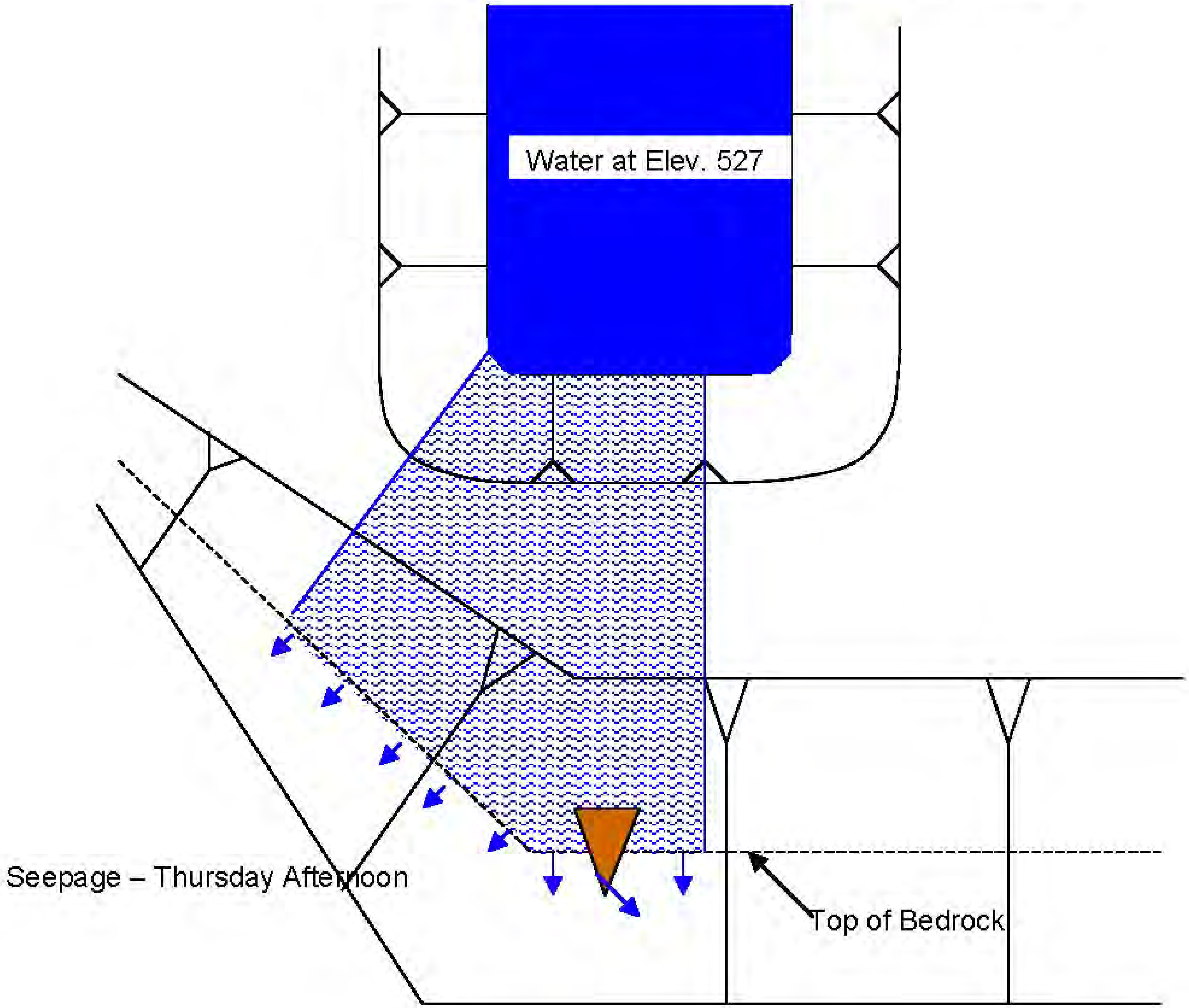
Simplified Plan View – Left Abutment



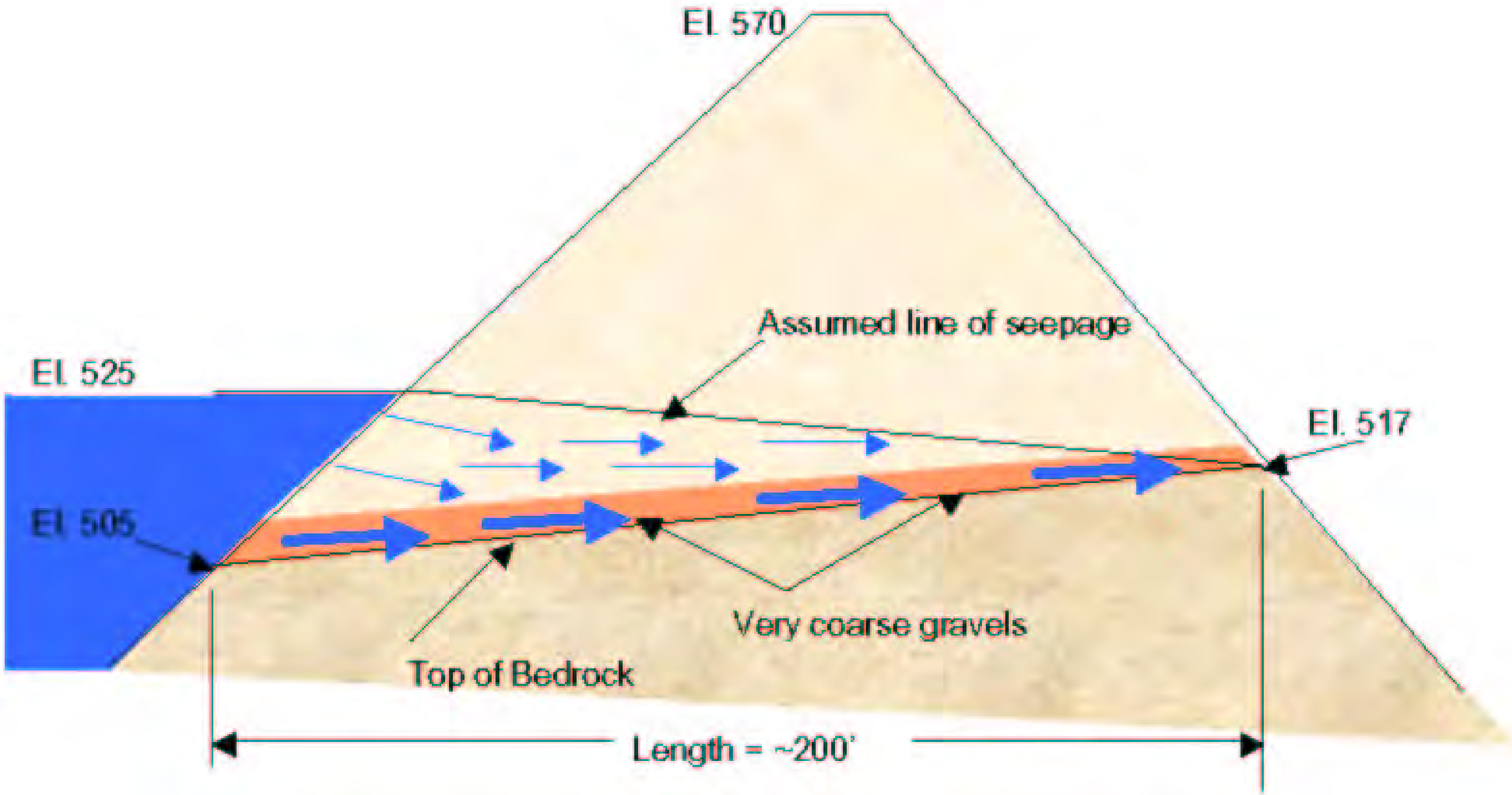
Simplified Plan View – Left Abutment



Simplified Plan View – Left Abutment



Cross-Section through Thinnest Section of Left Abutment



2004 8 1

- 2 gpm of seepage
- Water cloudy, but not muddy
- Flow rate, clarity constant

2005 1 14

LA District’s Opinion on the Seepage

- Predictable, given the site geology
- Quantity of seepage increased as the saturation front developed
- Low head, low exit gradient
- No cause for concern, but “V-Trench” must be monitored

Small leak, big response

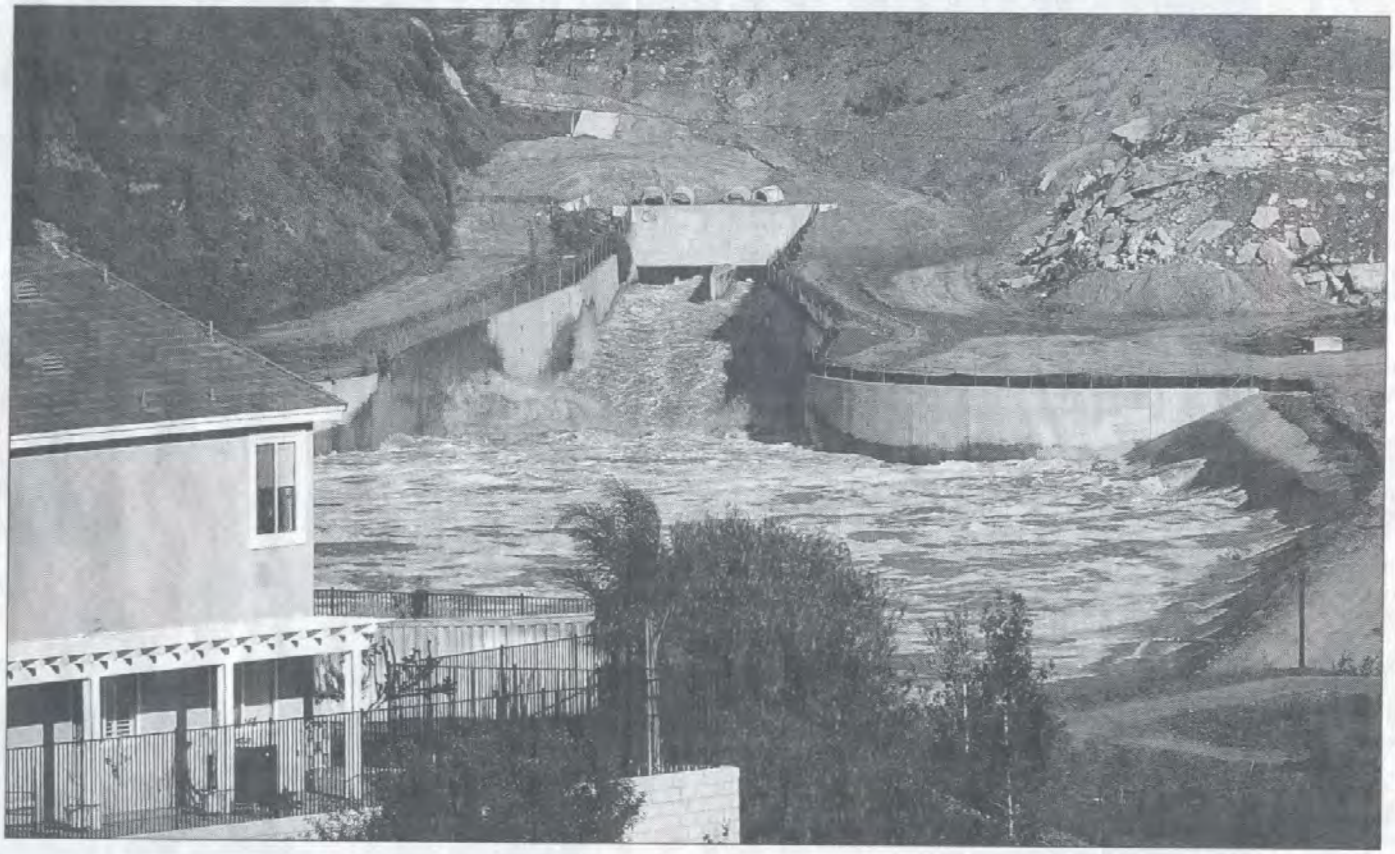
Easy repair needed when water seeps from Prado Dam after recent deluge, prompting Corona, O.C. evacuations.

By PAT BRENNAN and AMANDA BECK
THE ORANGE COUNTY REGISTER

A leak at Prado Dam on Friday that initially worried city and county officials, prompting evacuations, turned out to be small and relatively easy to repair. But it served as a powerful reminder of the enormous force of the water that fell on Southern California during more than four days of rain that rapidly filled the basin behind the dam, just northeast of Orange County.

Q: What caused the leak?
A: Construction crews with a contracting firm, Yeager-Skanska Inc. in Riverside County, are raising the dam by 28 feet to provide increased flood protection for Orange County.
They are also installing a

cials. Early Friday morning, Army Corps engineers thought there could be a small chance that the leak



OVERFLO An outlet Prado Dan releases w at high cap ity Friday, when a lea at the dam caused eva uations of more than 2,000 in nearby hom The leak, i face of the dam, devel oped after heavy flow from the re cent storm filled a pit is normally placing pre sure on the dam.

BRUCE CHAMBERS, THE REGISTER

Prado Dam springs a small leak

A small leak in Prado Dam prompted evacuations of more than 2,000 people Friday. The leak, in the

Floods and flood control

1,000 people evacuated by Corona dam

State: Seepage threatened to flood area; release eases pressure.

By Ryan Pearson
Associated Press

CORONA — Authorities released a fierce, brown river of water from a Riverside County dam and evacuated more than 1,000 people from its path Friday after a temporary earthen barrier at the site began seeping water.

The U.S. Army Corps of Engineers unleashed more than 10,000 cubic feet of water per second to relieve pressure on the earthen dam 50 miles east-southeast of Los Angeles after more water than usual began pushing through the dirt of a temporary coffer dam that is protecting workers who are extending and raising the dam.

"That's like a swimming pool every second," Corona Mayor Darrell Talbert said.

The water gushed into the Santa Ana River, whose banks were deep enough to handle the flow without flooding, said Lt. Col. John Guenther, deputy commander of the

... photographs the swollen Santa Ana River from the entrance bridge to Green River Golf Club Saturday morning.

Residents leery over returning

CONTINUED FROM A1

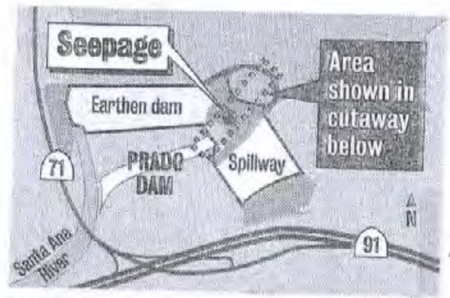
Officials with the Army Corps of Engineers, which had been raising the dam to increase flood protection, said they were satisfied with the repair job, adding that the seepage of as much as 10 gallons a minute was minor and didn't threaten the dam's safety.

"The pressure behind the dam was the most ever, more than it's had since it's been built," spokesman Fred-Otto Egeler said. "We had to release pressure from the dam but there was no imminent danger. It wasn't us who declared it a disaster."

The seepage developed Thursday night after weeks of heavy rain raised the water above a temporary barrier called a cofferdam that was designed to protect workers and the construction project.

Water spilled over the cofferdam and put pressure on a naturally occurring embankment of bedrock, gravel and soil alongside the dam. Earthmovers had carved into the embank-

STOPPING A LEAK: Seepage was discovered Thursday on the downstream face of Prado Dam where construction was being done on the new intake gate and outlet works. The Army Corps of Engineers took immediate steps to correct and repair the problem.

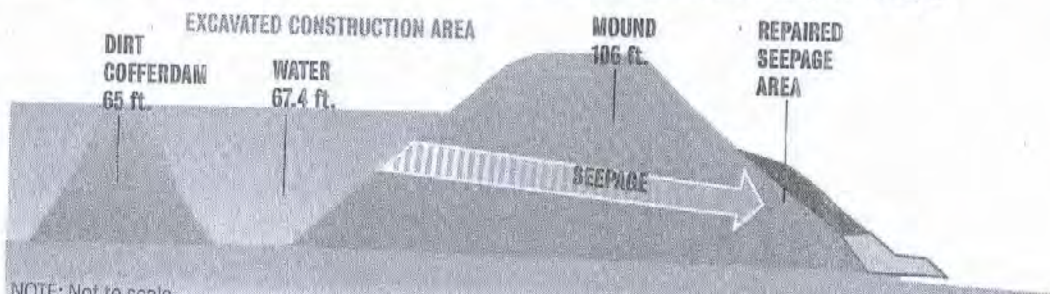


The problem:

- The temporary dirt cofferdam was built 65 feet high to keep water out of an area excavated for construction.
- Recent heavy rains caused Prado Reservoir to rise to 67.4 feet, which flooded the area.
- Water seeped through the hill that is part of the earthen dam.

The solution:

- Water being released from the dam has been increased from 5,000 to 10,000 cubic feet per second to drop the reservoir level and relieve pressure on the dam.
- The face of the dam where seepage has been found is being shored up with additional dirt.
- The seepage area is being reinforced with a fine mesh called geotextile to keep it stabilized.



but it's good to be informed," Trifunac said. "I don't want to scare you or leave the wrong impression, but dams are complex structures and it takes a lot of looking at details to know what is going on."

If he lived downstream from the Prado Dam, Trifunac said, "I would invite some very knowledgeable people who design dams to give a talk."

The Prado Dam was built in 1941 to protect then-agricultural Orange County from repeated floods, and that protection enabled the later suburbanization of that region.

David Moreno recalled his father's escape in the late 1930s from a flood that killed a thousand head of cattle and forced his family from the rural town of Prado.

"He had to run for his life," said Moreno, 54, of Norco. "From the time they could get out of the house and climb to where Highway 71 is, it flooded that quick."

The Army Corps of Engineers

VOL 10 NO 21 JANUARY 28-FEBRUARY 3 2005 ~ OCWEEKLY.COM ~ SERVING THE [illegible] OF ANAHEIM SINCE 1995

BATTLE OF THE BOONDOGGLES (LIGHT-RAIL DIVISION) • **DON'T BLAME GOD** IF PRADO DAM BREAKS
NU-METAL GODS HELMET • **THE MAN WHO LOVED TWO BRAINS:** SONTAG AND KAEL

OC WEEKLY

FREE

NECKFACE'S DEVIL,
THOMAS CAMPBELL'S ABSTRACTS
AND ED TEMPLETON'S
SAD LITTLE MONSTERS
HELP MAKE

Events of Thursday Evening, 13 January 2005

- **1500 hrs.** I inspect area and note the seepage area had expanded (approx 200 sq ft) but no velocity increase. Rate approximately 20 gpm. No piping of fines were observed. Approximately 2 gpm still out of V-trench. I met with YSI CQC and earthwork foreman to discuss potential actions should situation deteriorate. Briefed RE that I did not see a problem at this time.

- **1700 hrs.** I leave site for the evening.

- **1730 hrs.** At request of YSI CQC representative, their geotechnical consultant arrives to inspect site. He did not share my confidence.

- **1930 hrs.** Corps Dam Expert, after speaking with Contractor's consultant, understands that seepage was now "15 times greater than 24 hours ago, that it contained fines, that headward erosion and sloughing were observed along the gravel and cobble layer and that the consultant believes a stability berm is needed immediately."

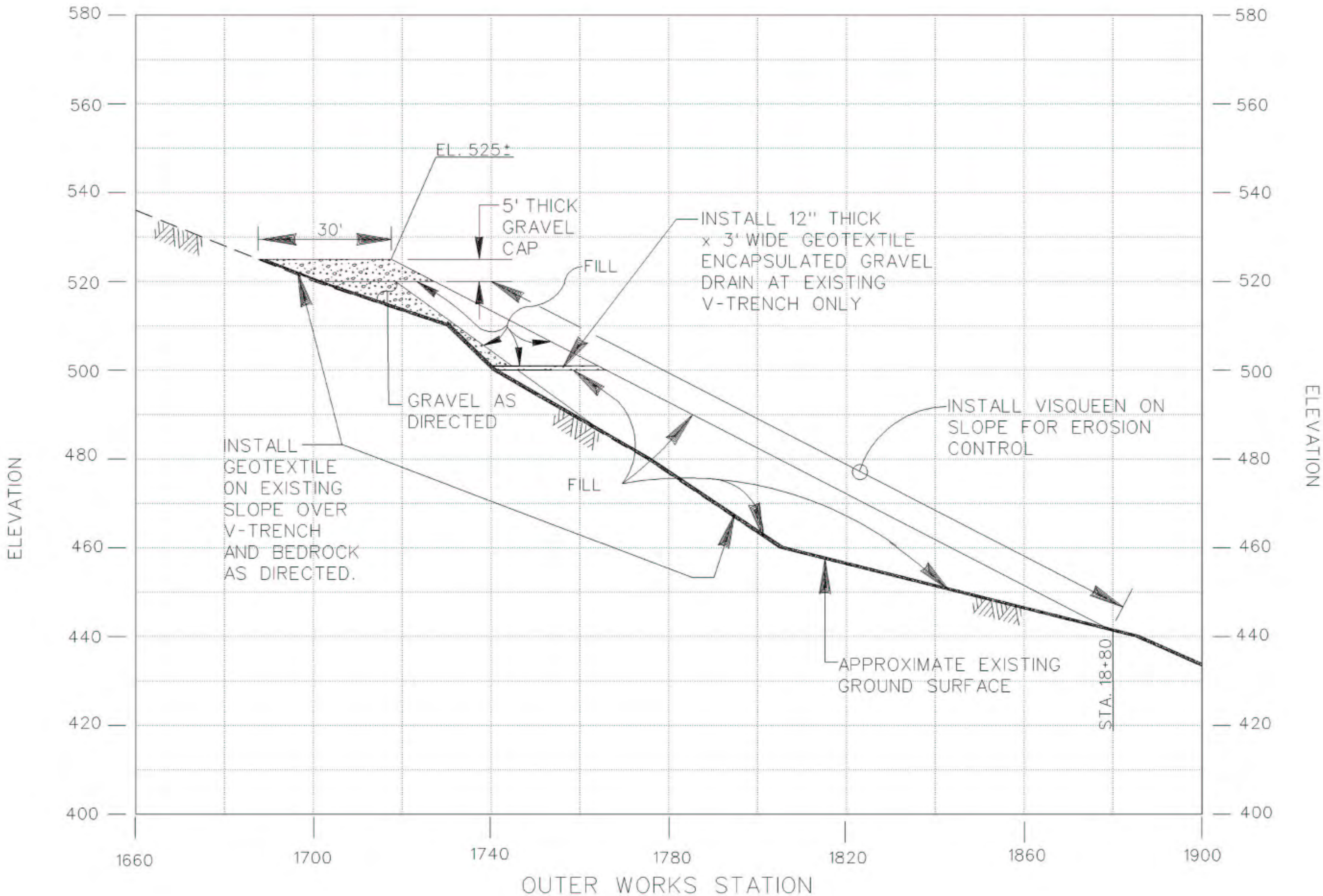
- **1930 hrs.** Speaking to RE, Corps Dam Expert concurs with consultants recommendation to mobilize the contractor's equipment to begin construction of the stability berm and increase discharge to 10,000 cfs.

Events of Thursday Evening, 13 January 2005

- **2022 hrs.** Reservoir Operations begin to ramp up releases.
- **2100 hrs.** I returned and found no significant change in seepage. Request my supervisor and Byron Rathbun (7 Oaks Dam embankment engineer) to come to the site and provide additional opinions.
- **2200 hrs.** Contractor requests California Highway Patrol assist with traffic control when they arrived at the dam. Corona PD hear CHP radio traffic about closing Hwy 71 to get additional construction equipment to Prado and informed the Corona Fire Department.
- **2200 hrs.** Mr. Rathbun and Mr. James Farley, Chief of Soils Design and Materials Section, arrived and inspected the site. Both concurred that the seepage did not merit mitigating measures at that time.
- **2300 hrs.** District Commander directs RE to begin construction of the buttress for preventative measures.

So why did Prado make the news?

1. Extremely large event – record 5-day inflow
2. Inaccurate information
   - Seepage volume increased, not seepage velocity
3. Incorrect assessment
   - GE believed seepage to be carrying fines.
   - Mistook a small localized slump for headward erosion
   - Post-La Conchita, he did stability analysis.
4. Unnecessary recommendation – lead to emergency mobilization
5. Poor communications with locals



BUTTRESS FILL SECTION
SCALE: 1" = 20'


2005 1 14


2005 1 15


2005 1 15


2005 1 19


STARBUCKS COFFEE
Careful, the beverage you're about to enjoy is extremely hot.


Dung
STARBUCKS
COFFEE

Lessons Learned

1. Anticipation: I should have anticipated that this could be a concern and have fully briefed the RE
2. Coordination: Even experts need to work through people experienced at the site
3. Communication: We did a poor job apprising the locals of what we were doing and why


Thank you
2005 2 23

Dynamic Testing and Numerical Correlation Studies for Folsom Dam

Ziyad Duron (Harvey Mudd College)
Enrique E. Matheu (USACE Engineer Research and Development Center)
Vincent P. Chiarito (USACE Engineer Research and Development Center)
Michael K. Sharp (USACE Engineer Research and Development Center)
Rick L. Poeppelman (USACE Sacramento District)

Presented by
Enrique E. Matheu, PhD
Geotechnical and Structures Laboratory
Engineer Research and Development Center
Vicksburg, MS

2005 Tri-Service Infrastructure Systems Conference and Exhibition
St. Louis, MO – August 2-4, 2005

Introduction

- **Full-Scale Dynamic Testing**
  - Dynamic testing can be effectively used to identify the main dynamic response characteristics of concrete dams.
  - These tests can provide information regarding the relative importance of interaction mechanisms involving the dam, the impounded reservoir, and the underlying foundation region.
  - Test results can be used to assess the limitations of different numerical models employed to predict the response of the system under severe seismic excitations.
  - However…

    Field testing of concrete dams has not been widely embraced in the US as an essential component in the process of evaluating the seismic performance of these structures.

Introduction

- **Folsom Dam Description**

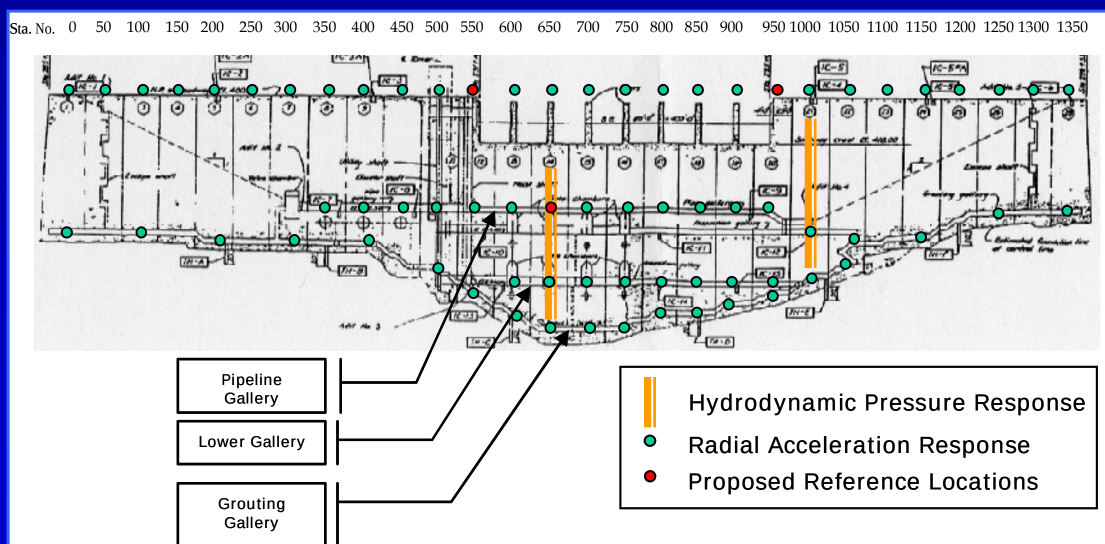
  - Design/construction by USACE (1948-1956), transferred to USBR (1956)
  - Maximum height of gravity section is 340 ft with a crest length of about 1,400 ft.
  - 28 monoliths, 50 ft wide each.
  - Main spillway: 5 ogee monoliths, two tiers of 4 outlets. Emergency spillway: 3 flip bucket monoliths.
  - Embankment wrap fill and wing dams

Introduction

- **Folsom Dam Dynamic Testing Program**
  - Research study conducted by the U.S. Army Engineer Research and Development Center (ERDC) consisting of a series of field tests and numerical analyses performed on Folsom Dam, California.
  - Ambient surveys and forced vibration tests were conducted to determine the main dynamic characteristics of the dam-foundation-reservoir system.
  - Numerical studies of the observed response behavior were performed using 2D and 3D models of the system.

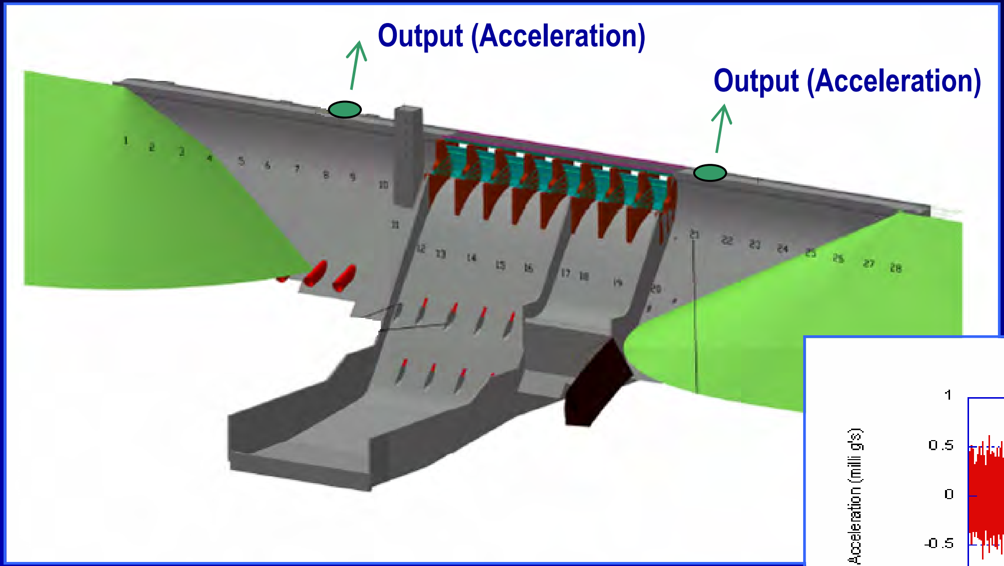
Ambient Survey

- **Survey Description**
  - **Ambient survey conducted in March 2004.**
  - **At each monitored location, ambient acceleration responses excited by environmental conditions were monitored over a 7-minute interval.**
  - **Ambient hydrodynamic pressure responses were also acquired behind monoliths 14 and 21.**

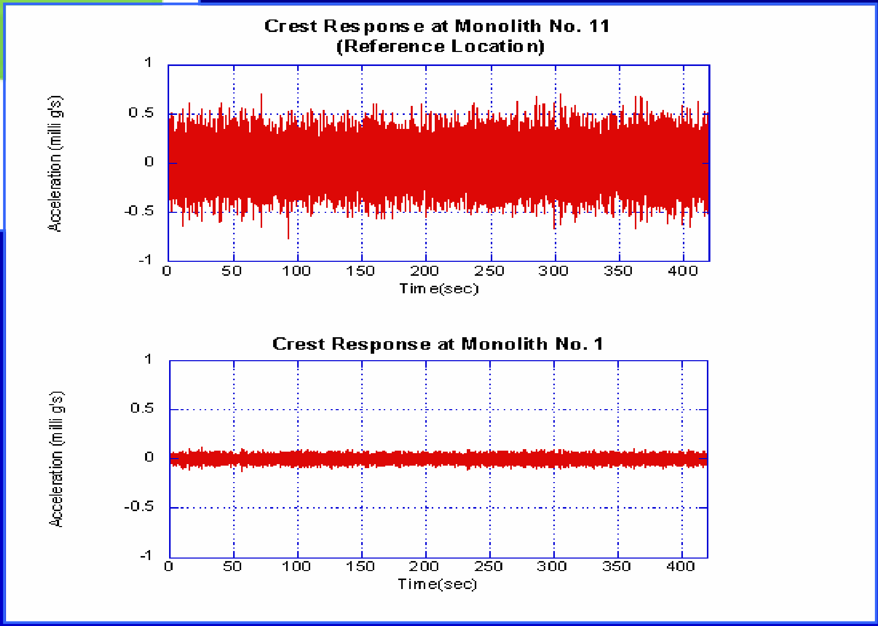


Ambient Survey

- Sample Signals



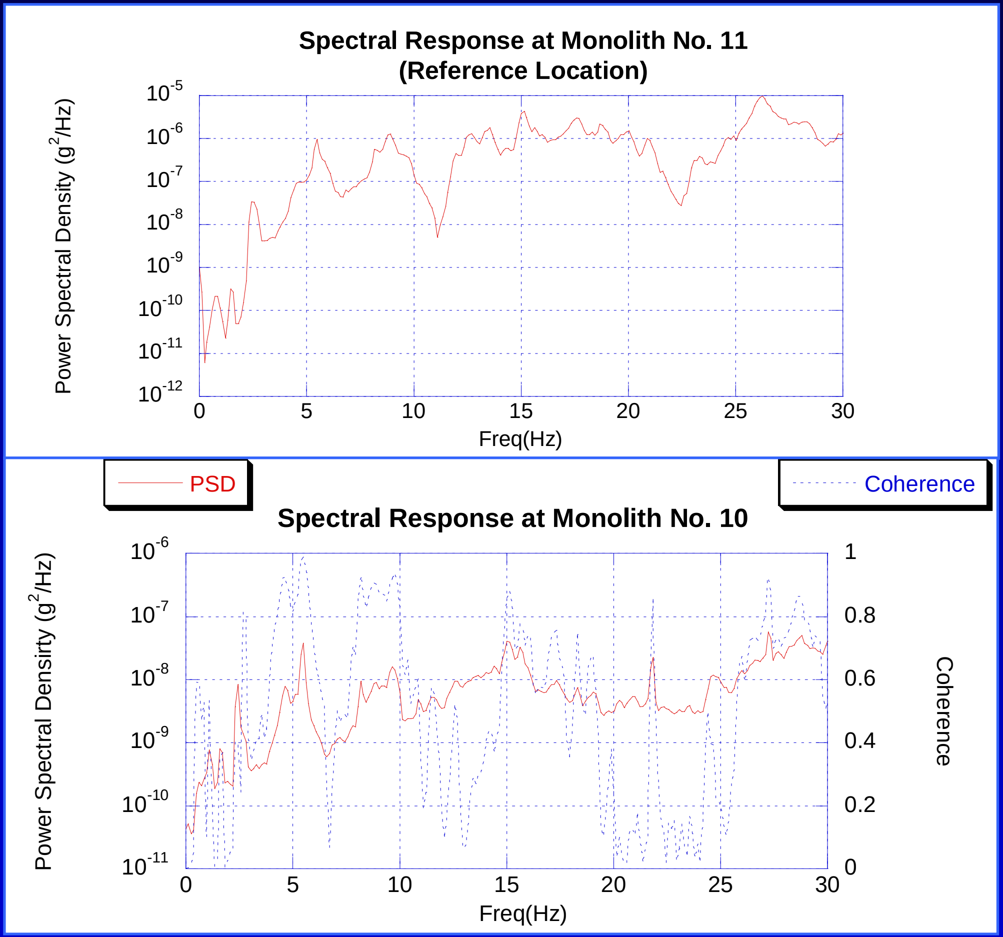
Typical peak acceleration levels range from 0.5 milli-g's at the crest of Monolith 11 to 0.1 milli-g's at the crest of Monolith 1



Noise threshold: 1 micro-g for Honeywell Q-Flex accelerometers QA-700, QA-750, and QA-900.

Ambient Survey

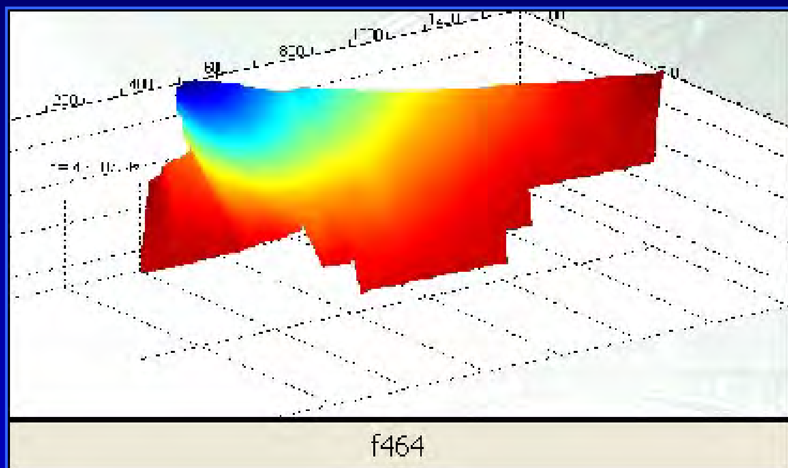
- **Results**
  - Spectral analysis conducted using the specially developed software *iDAMS*.
  - Both power spectral density and coherence must be examined.
  - Spectral response of Monolith 10 associated with relatively wide regions of coherence approaching unity between 4-6 Hz and between 8-10 Hz.



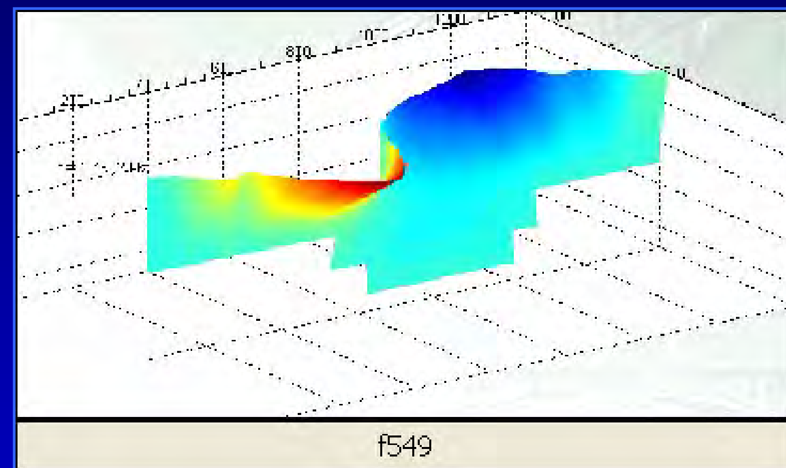
US Army Corps of Engineers

Ambient Survey

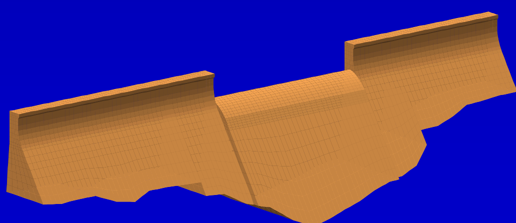
- Results
  - Analyses of global measured responses indicated near-monolithic behavior in the dam below 10 Hz.

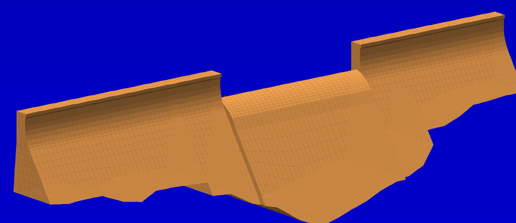


4.64 Hz



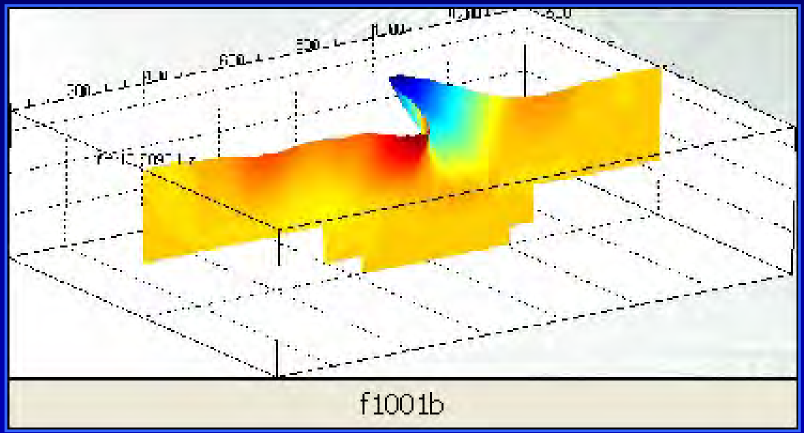
5.49 Hz





Ambient Survey

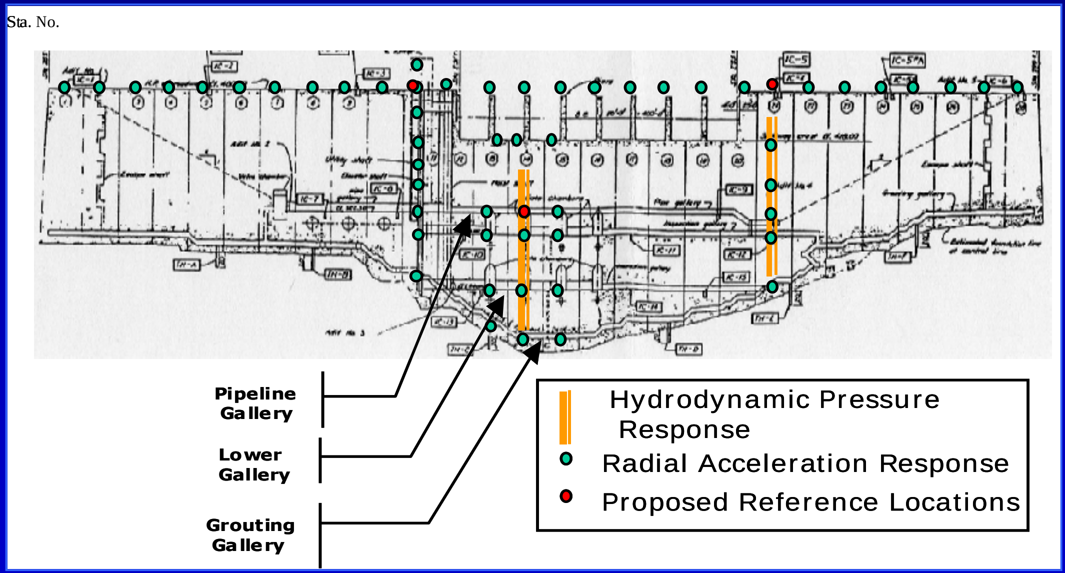
- **Results**
  - The portion of the roadway that spans the spillway section appears to respond with amplified motions in the vicinity of 10-12 Hz.
  - The response of the bridge deck above 10 Hz may require further investigation in order to determine whether it would remain operational during a seismic event.



10.01 Hz

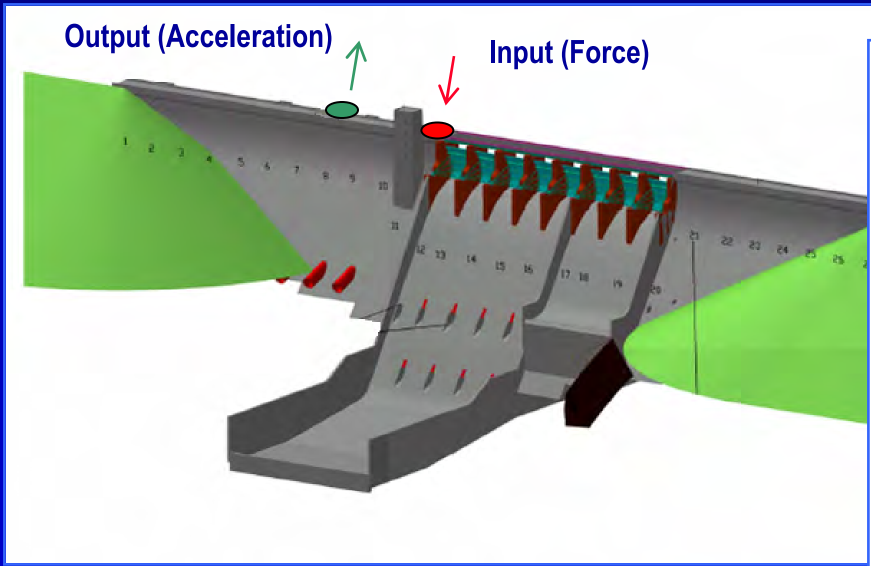
Forced Vibration Tests

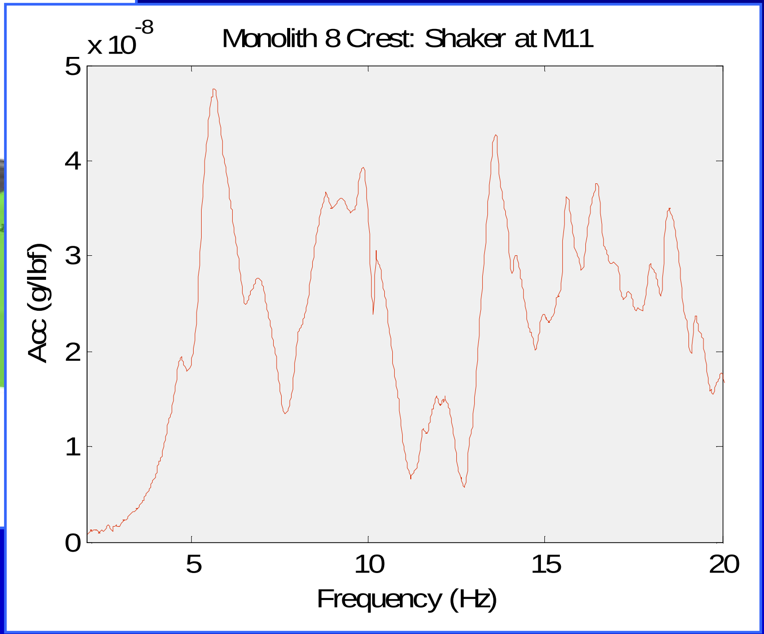
- **Test Description**
  - **Results from the ambient survey provided confidence that a single eccentric mass vibrator (shaker) would excite steady-state responses in the dam, reservoir and adjacent foundation.**
  - **Forced vibration tests conducted at Folsom Dam in June 2004.**
  - **Shaker locations:**
    - **Monoliths 11, 14, 21**



Forced Vibration Tests

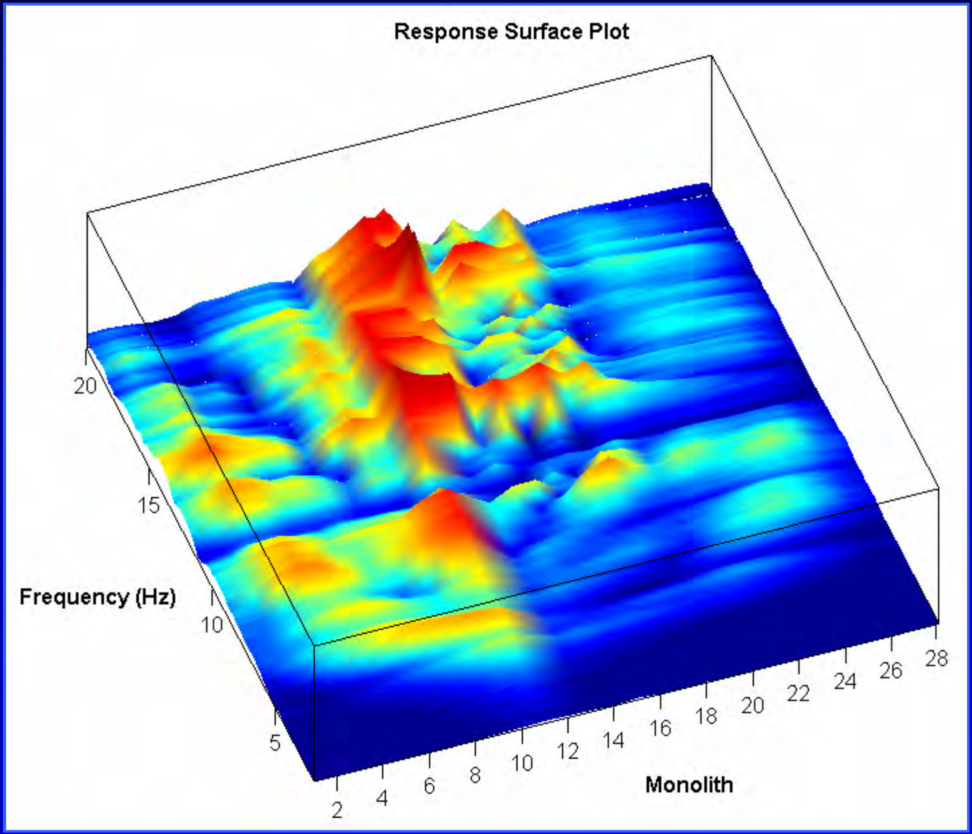
- **Acceleration Frequency Responses**
  - Peak below 5 Hz corresponds to the fundamental symmetric resonance at 4.65 Hz.
  - Large peak below 6 Hz corresponds to the second fundamental resonance at 5.46 Hz.





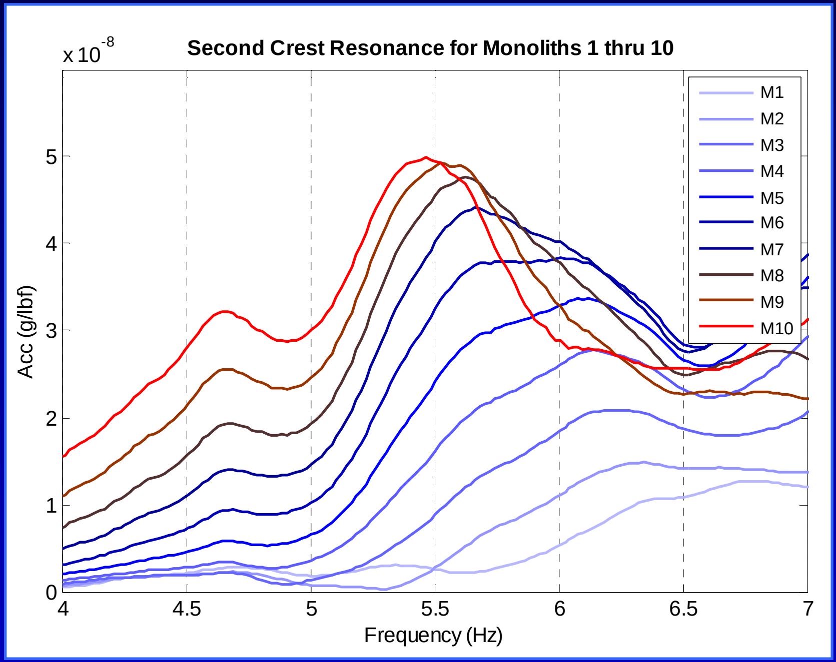
Forced Vibration Tests

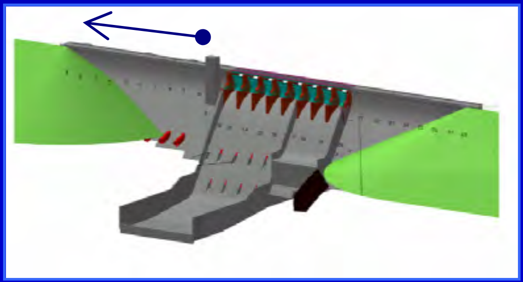
- **Dominant Responses**
  - **Global comparison of acceleration response functions measured with shaker mounted on Monolith 11 (crest).**
  - **Below 10 Hz, second resonance dominates (Monoliths 4-12).**
  - **Above 12 Hz, response clearly dominated by spillway behavior.**



Forced Vibration Tests

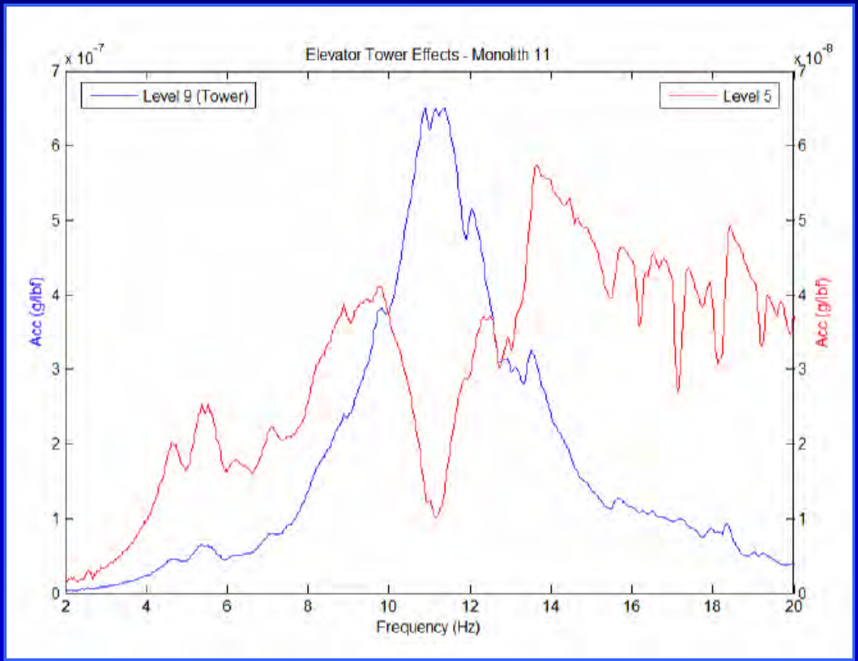
- Crest Responses for Monoliths 1-10
  - Stationary fundamental resonance at 4.65 Hz.
  - Sliding character of second system resonance beginning at 5.46 Hz.
  - Largest and narrowest resonance peak at Monolith 10.
  - Smaller and wider peaks for monoliths closer to the abutment.





Forced Vibration Tests

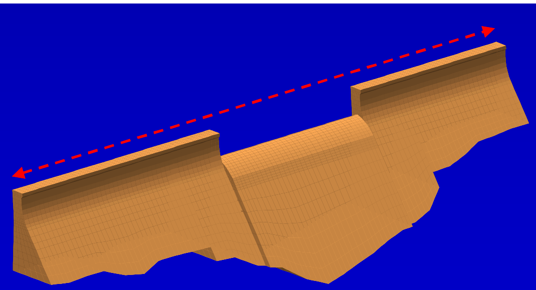
- **Influence of Elevator Tower**
  - **Tower exhibits fundamental resonance near 11.6 Hz (blue curve) that coincides with an anti-resonance in the dam (red curve) indicated by the acceleration response acquired 60 ft below the crest in Monolith 11.**

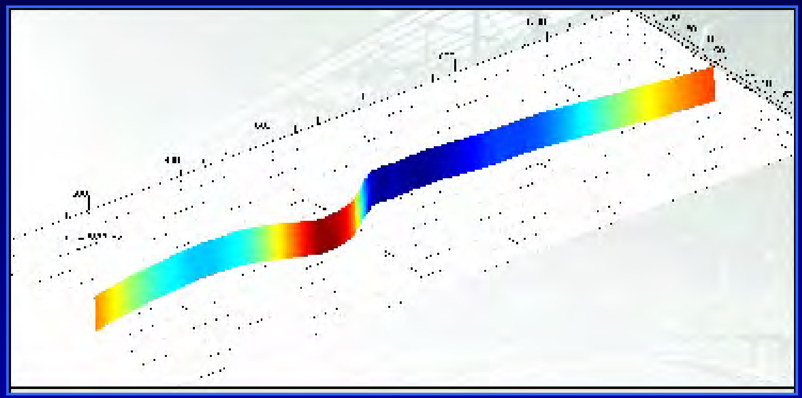


Forced Vibration Tests

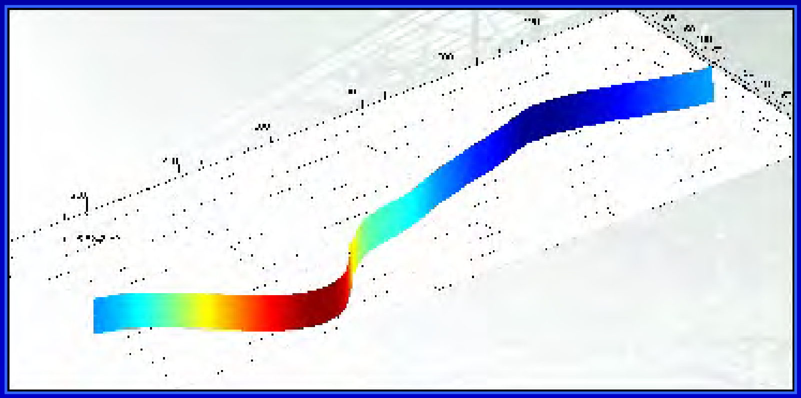
- System Characteristics

Resonant Frequency (Hz)	Half-Power Method	Pole Fitting
4.65	-	4.0-6.5 %
5.46	5.6-8.4 %	4.8-7.0 %
6.24	-	4.0-8.0%
7.16	6.3-8.0%	4.0-7.8%
8.00	-	-
8.87	-	-





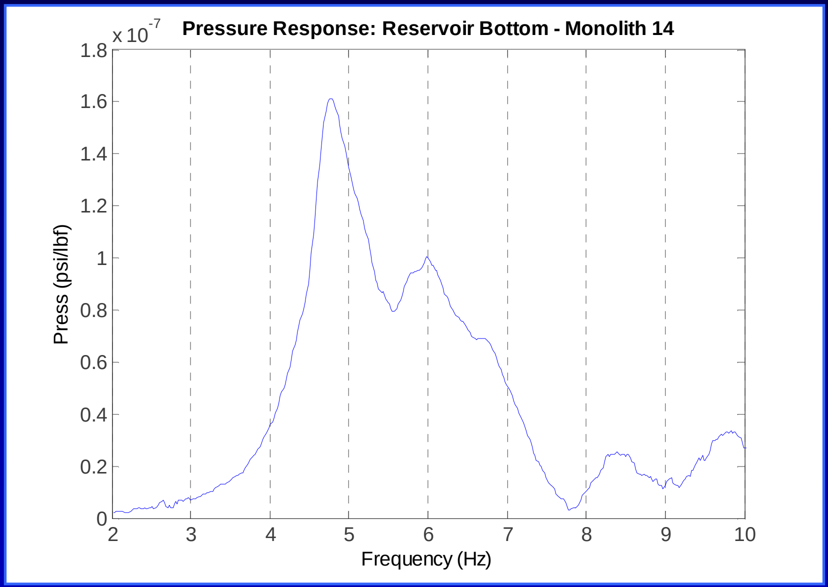
4.65 Hz

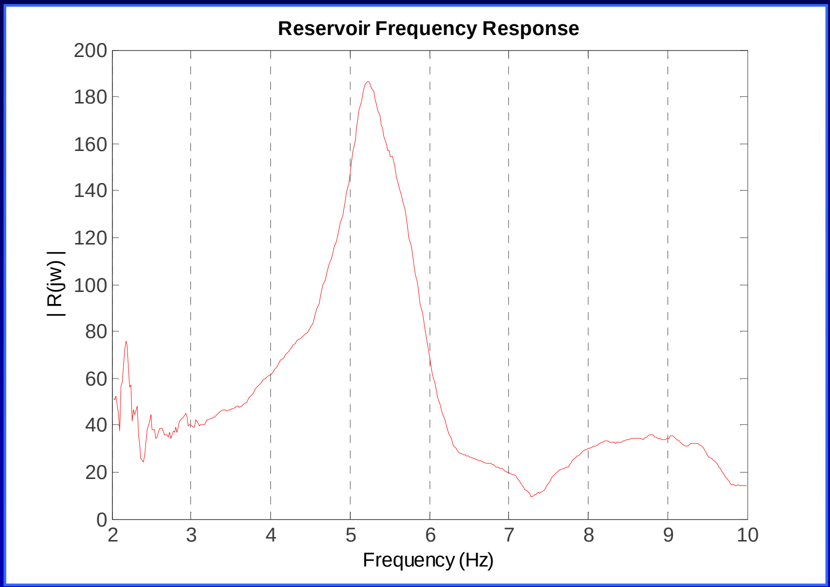


5.46 Hz

Forced Vibration Tests

- Reservoir Response Characteristics

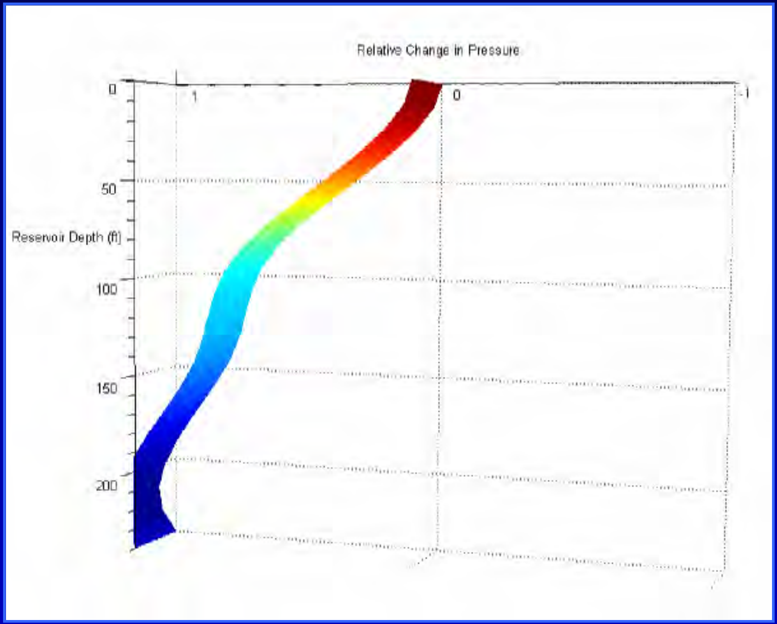


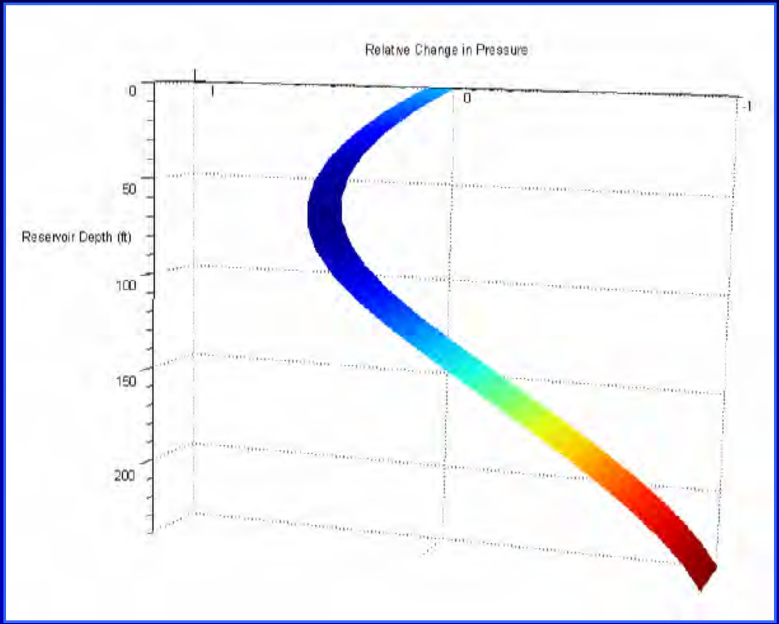


$$H_{eff} = \frac{C_w}{4 f_{reservoir}} = \frac{4720\,\mathrm{ft/sec}}{4 \cdot 5.23\,\mathrm{Hz}} \cong 226\,\mathrm{ft}$$

Forced Vibration Tests

- Reservoir Response Characteristics





Fundamental resonance for hydrodynamic pressure profile

Second resonance for hydrodynamic pressure profile

Numerical Correlation Studies

- **Preliminary Study Objectives**
  - To develop numerical models that represent the dam, reservoir, and foundation to capture observed response behavior acquired during forced vibration tests at Folsom Dam (“baseline model”).
  - Key issues:
    - Dam-foundation interaction

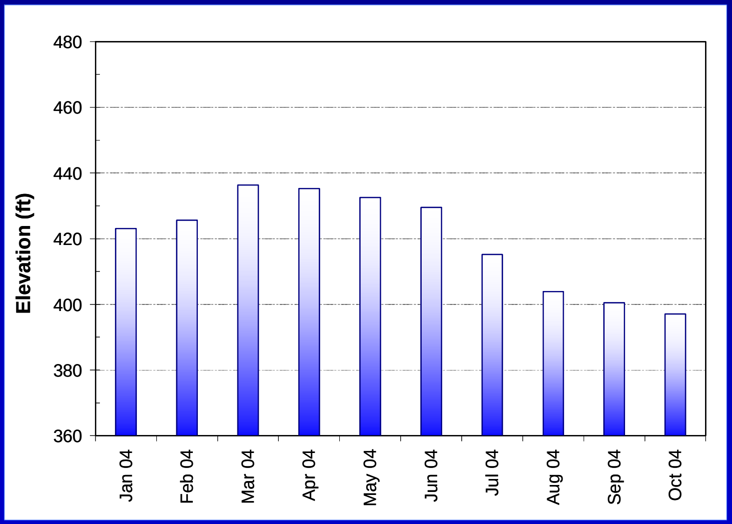
      Consideration of foundation flexibility effects
    - Dam-reservoir interaction

      Incorporation of hydrodynamic effects
    - Tower influence on dam response

      Consideration of vibration reduction by dynamic tuning

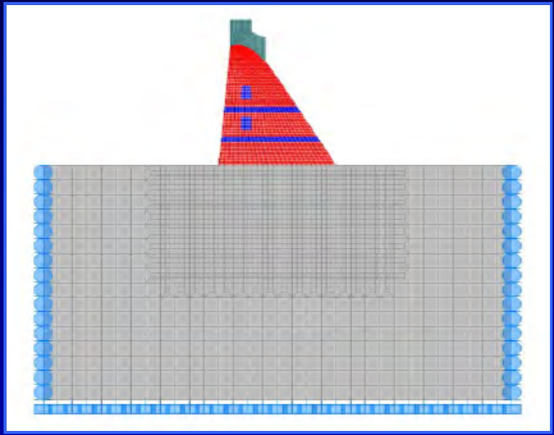
Numerical Correlation Studies

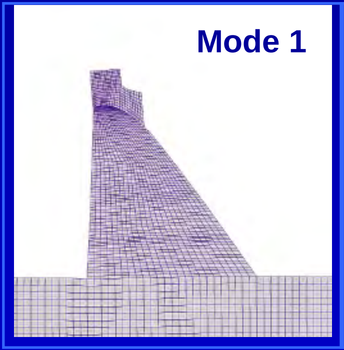
- **Baseline Model Assumptions**
  - Linear elastic behavior assumed throughout system.
  - 3D dam model (8,103 solid brick elements).
  - Includes tower, roadway, and varying spillway monolith geometries.
  - Foundation region idealized as massless (stiffness only contribution).
  - Reservoir modeled using Westergaard's simplified model to define added masses along upstream face.
  - Reservoir elevation 430'.

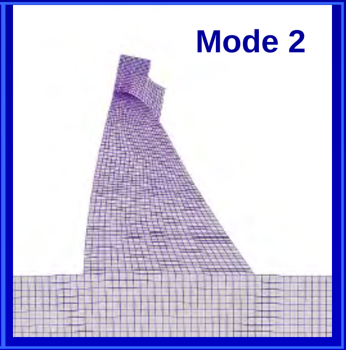


Numerical Correlation Studies

- 2D Models (SAP2000)



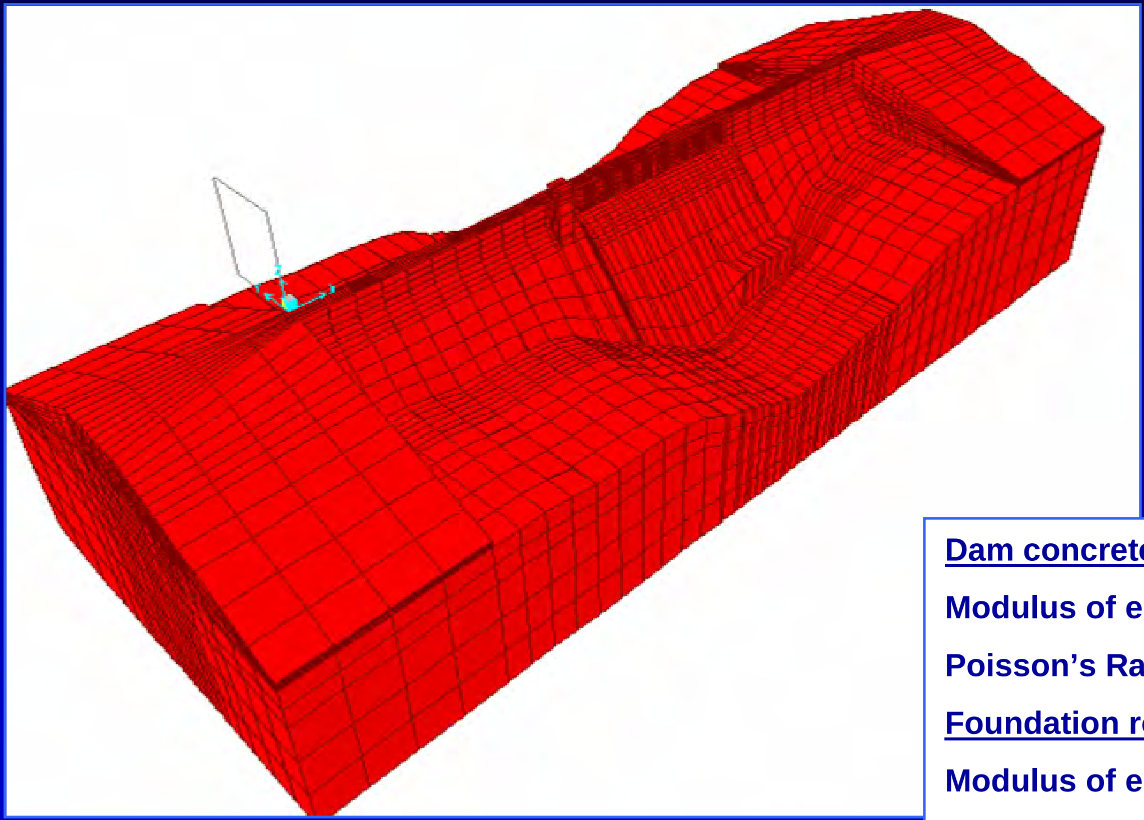




Mode	Natural Frequencies [Hz]			
	Monolith 14		Monolith 21	
	Rigid	E_c/E_f = 0.25	Rigid	E_c/E_f = 0.25
1	5.23	4.68	5.00	4.67
2	12.31	10.80	10.50	9.52
3	14.63	12.43	16.80	14.37
4	19.96	18.31	18.98	16.95
5	25.73	24.40	28.53	26.09

Numerical Correlation Studies

- 3D Model (SAP2000)



Dam concrete:

Modulus of elasticity (E_c) = 849,000 Kips/ft^2

Poisson's Ratio = 0.19

Foundation rock:

Modulus of elasticity (E_f) = 1,584,000 Kips/ft^2

Poisson's Ratio = 0.30

E_c / E_f = 0.54

Numerical Correlation Studies

- Measured Resonances vs Computed Natural Frequencies

Ambient Vibration Survey Resonant Frequency (Hz)	Forced Vibration Survey Resonant Frequency (Hz)	Natural Frequency (Hz) (SAP2000)
4.64	4.65	4.67
5.49	5.46	5.35
Not Observed	Not Observed	5.91
6.47	6.24	6.56
7.32	7.16	7.47
8.18	8.00	8.40
8.91	8.87	8.82

Numerical Correlation Studies

- **SAP2000 and EACD-3D (Empty Reservoir Condition)**

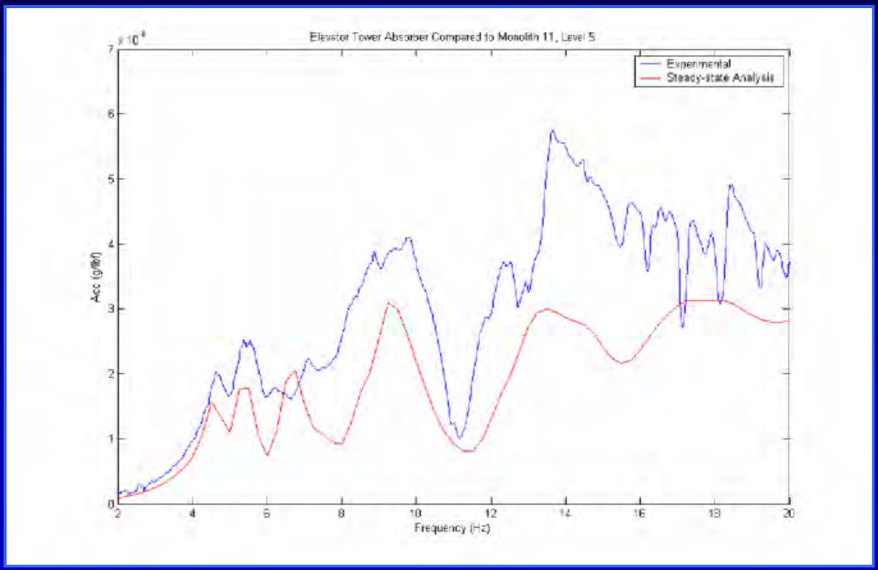
Natural Frequency (Hz)		
SAP2000	**EACD-3D**	**EACD-3D (Adjusted)**
5.71	6.06	5.71
6.29	6.67	6.28
6.84	7.30	6.87
7.45	8.01	7.54
8.61	9.41	8.86

– **EACD-3D will be used to quantify water compressibility effects including energy absorption due to sediments at the bottom of the reservoir.**

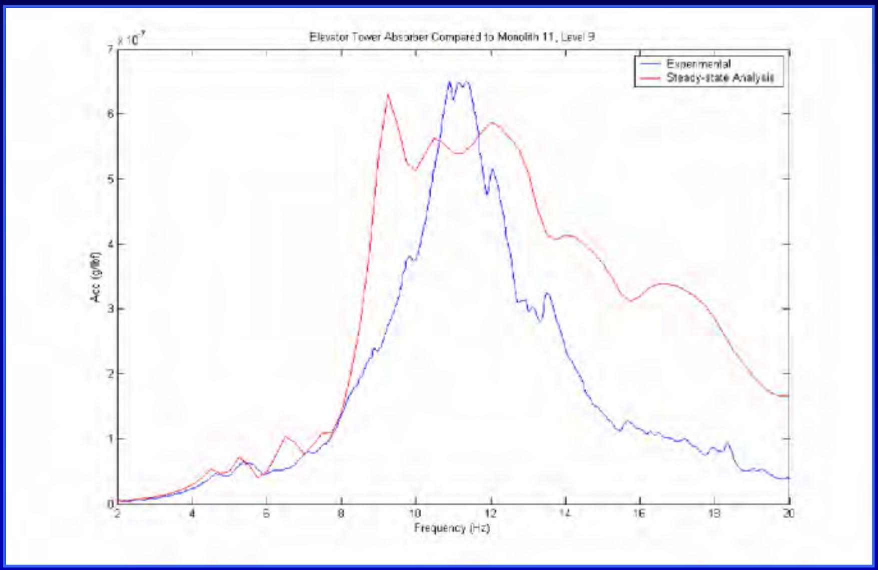
– **The flexibility of the foundation rock can be included but associated inertia and damping effects are ignored.**

Numerical Correlation Studies

- **Influence of Elevator Tower**



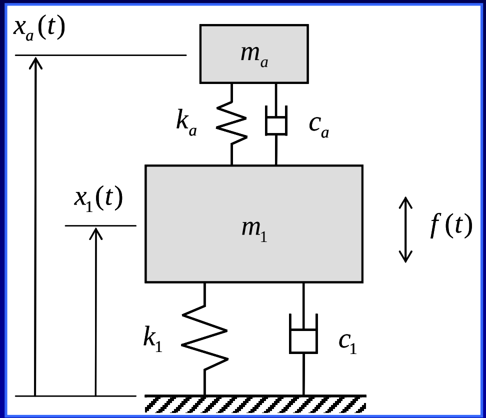
Comparison of measured and predicted response Level 5 (dam)



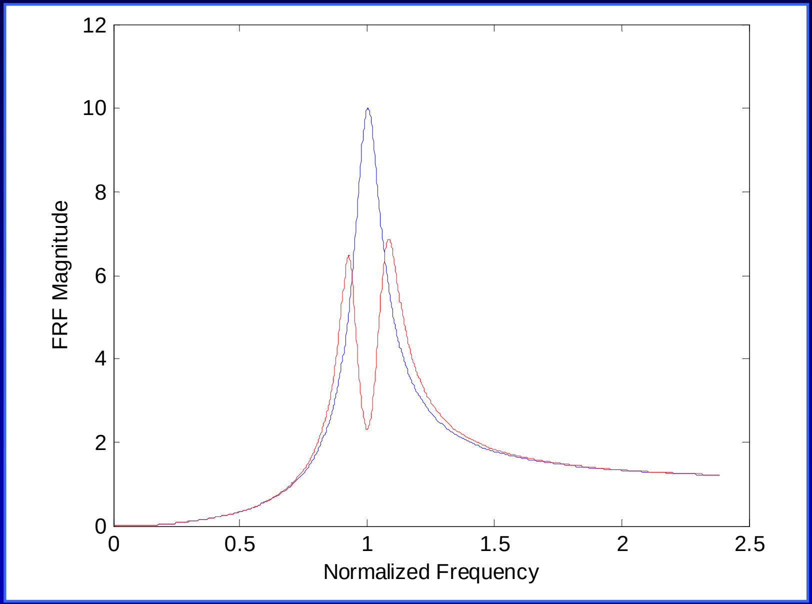
Comparison of measured and predicted response Level 9 (tower)

Numerical Correlation Studies

- **Elevator Tower as Tuned Vibration Absorber**



Tuned vibration absorber model

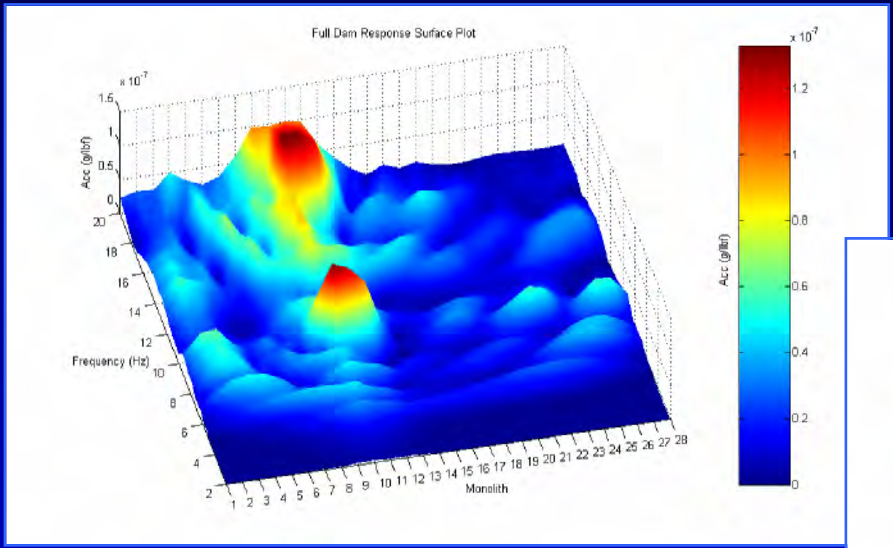


The blue line represents the response of the main system without the vibration absorber. The red line represents the response of the main system including the presence of the absorber.

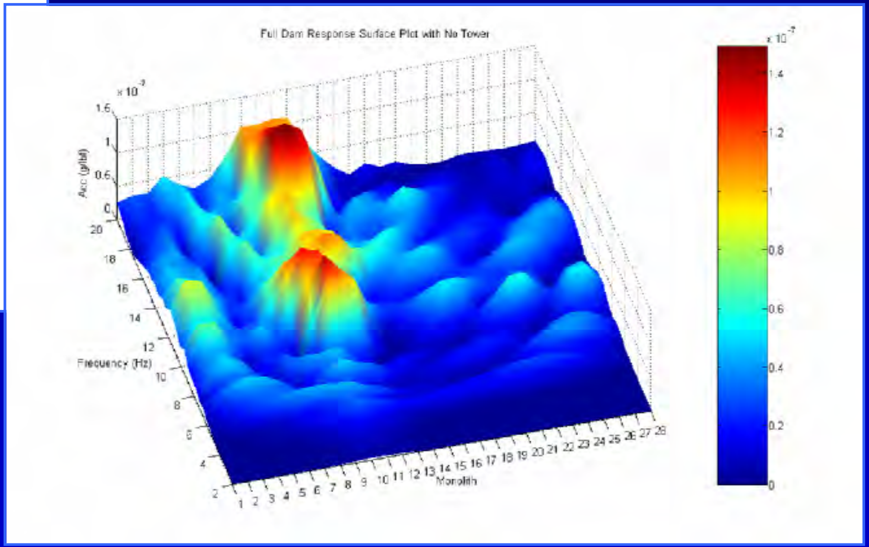
The response indicates two "split" resonances that straddle the original fundamental frequency.

Numerical Correlation Studies

- **Surface Plot Comparison of Crest Acceleration Responses**



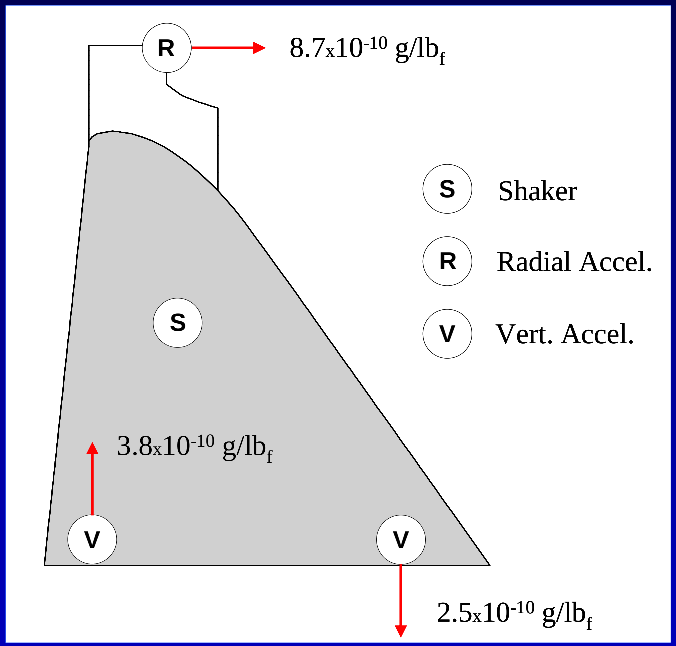
Tower included



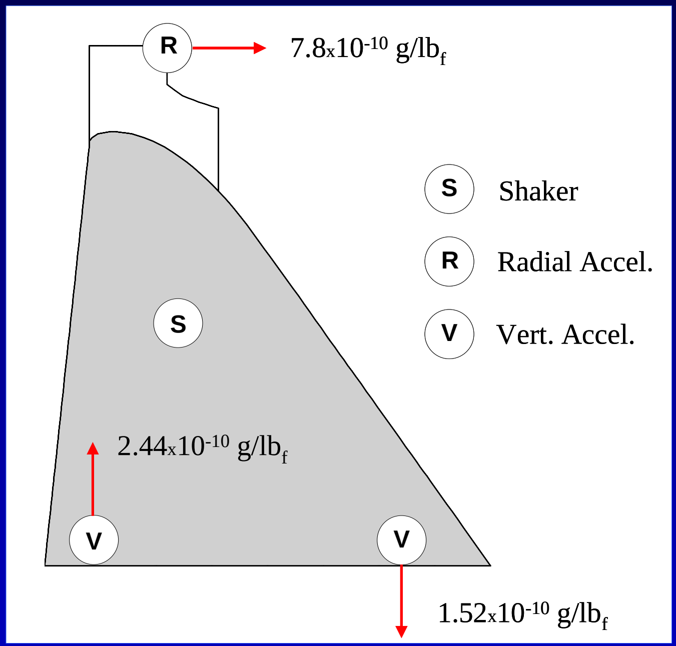
Tower removed

Numerical Correlation Studies

- **Foundation Flexibility Effects at Monolith 14**



Measured response



Numerical model

Summary

- A series of dynamic tests have been completed at Folsom Dam to gain detailed understanding of its dynamic response characteristics, including dam-foundation and dam-reservoir interaction.
  - Dam response behavior observed along the crest indicated monolithic dam response below 10 Hz.
  - The elevator tower acts as a vibration absorber tuned near 11 Hz and affects dam response across all monoliths.
  - Evidence of foundation flexibility was observed at the base of Monolith 14.
  - Fundamental reservoir resonance at 5.23 Hz influences the fundamental system resonance at 4.65 Hz.
- A preliminary numerical correlation study indicated that the 3D model is capable of capturing several major response characteristics at Folsom Dam.
  - Above 6 Hz, a variety of influencing factors will require further investigation including water compressibility effects and appropriate damping values for resonances at higher frequencies.

Acknowledgments

This research study was the result of a joint effort by personnel from Harvey Mudd College (HMC); ERDC Geotechnical and Structures Laboratory (GSL), and ERDC Information Technology Laboratory (ITL).

The research work described herein was performed by Prof. Ziyad H. Duron, Ms. Angela Cho, Mr. Eric Flynn, Mr. Nicolas Von Gersdorff, Mr. Robert Panish, and Mr. Nate Yoder, HMC; Mr. Vincent P. Chiarito, Dr. Enrique E. Matheu, and Dr. Michael K. Sharp, GSL; and Mr. Bruce Barker, ITL.

Prof. John F. Hall, California Institute of Technology provided technical review.

Mr. Rick L. Poeppelman, SPK, was the technical monitor.

Enrique E. Matheu, PhD
Engineer Research and Development Center
3909 Halls Ferry Road, ATTN: CEERD-GS-E
Vicksburg, MS 39180
Phone: 601-634-2692
enrique.e.matheu@erdc.usace.army.mil

Fern Ridge Dam, Oregon

Seepage and Piping Concerns

(Internal Erosion)

SPRA Training – 25 May 2005

2002 and 2003 OBSERVATIONS

Location of Depressions

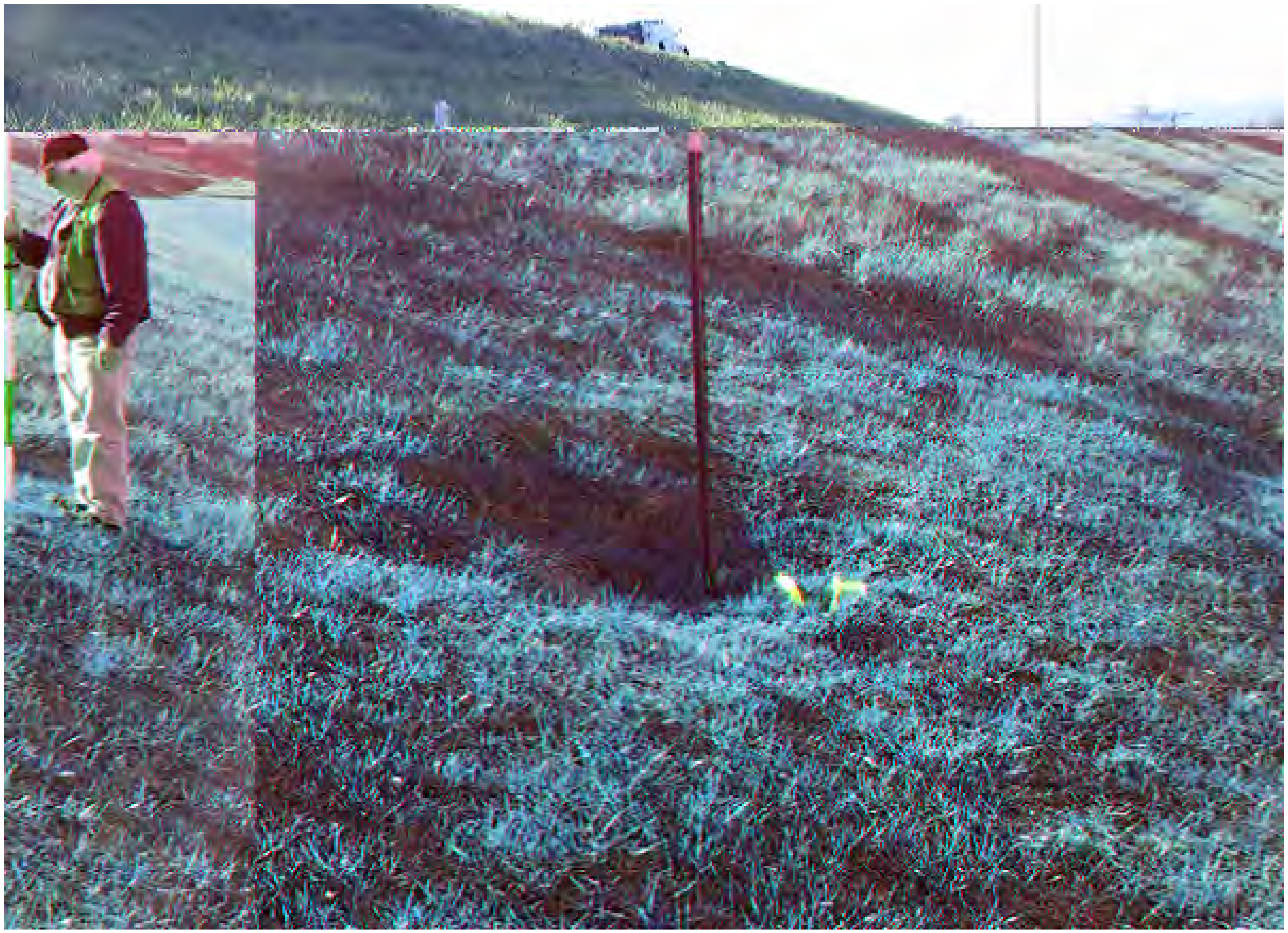
Sinkholes on D/S face

September 2002

February 2003

Station 44+00

Sinkholes on D/S face



February 2003

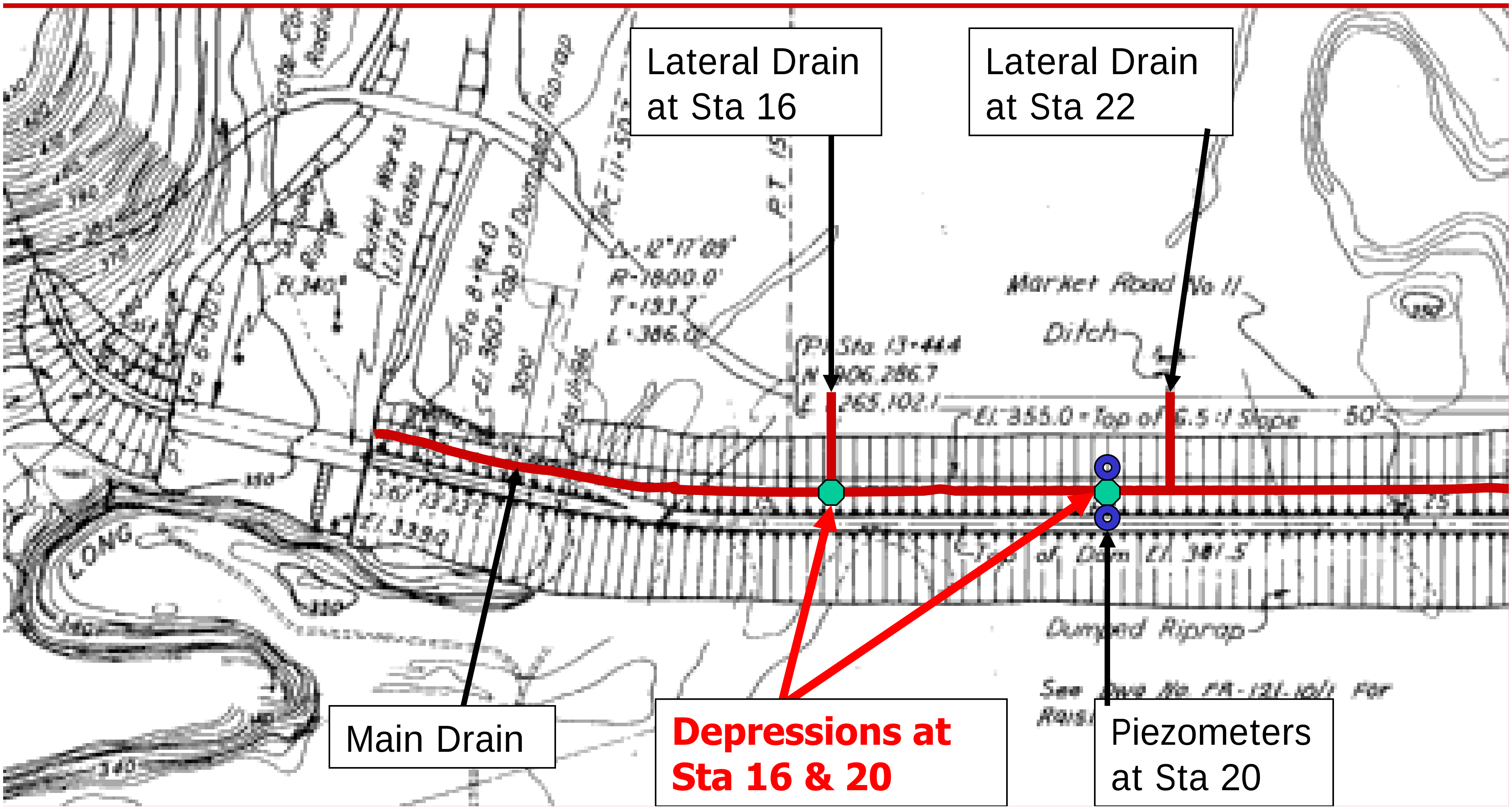
Station
20+00

Sinkhole on D/S face

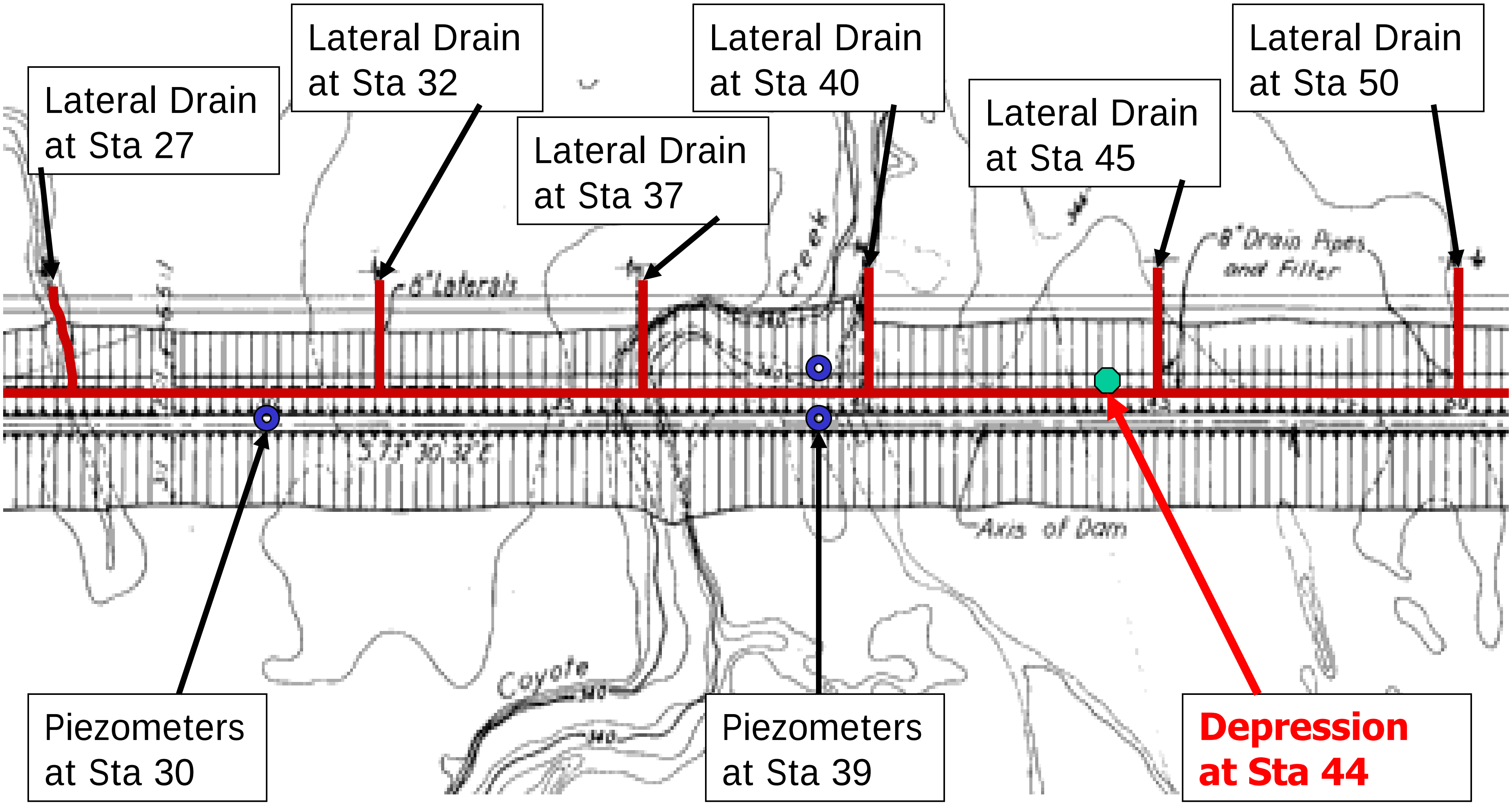
Station
16+00

February 2003

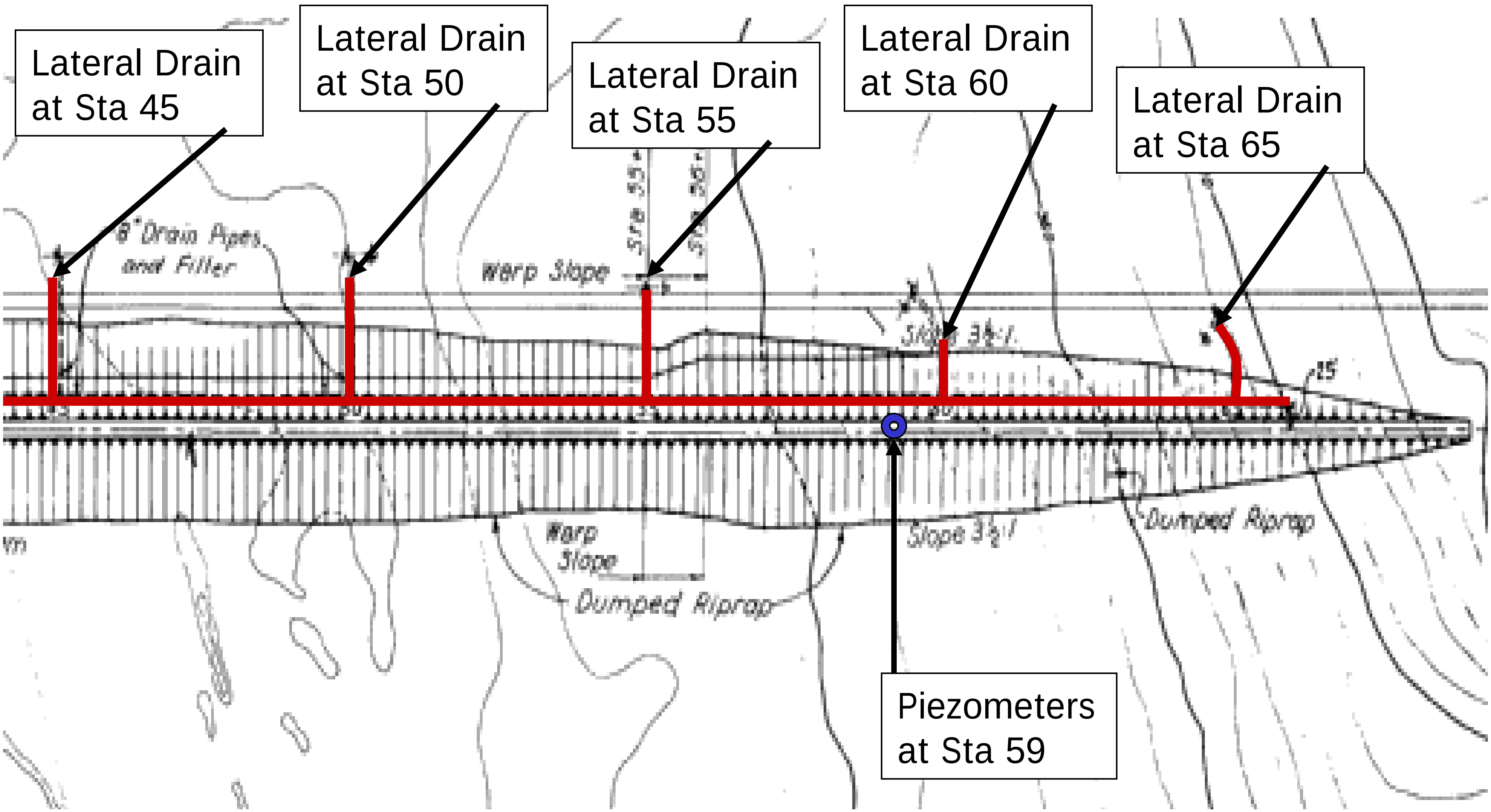
Plan View (Sta. 0+00 – 25+00)



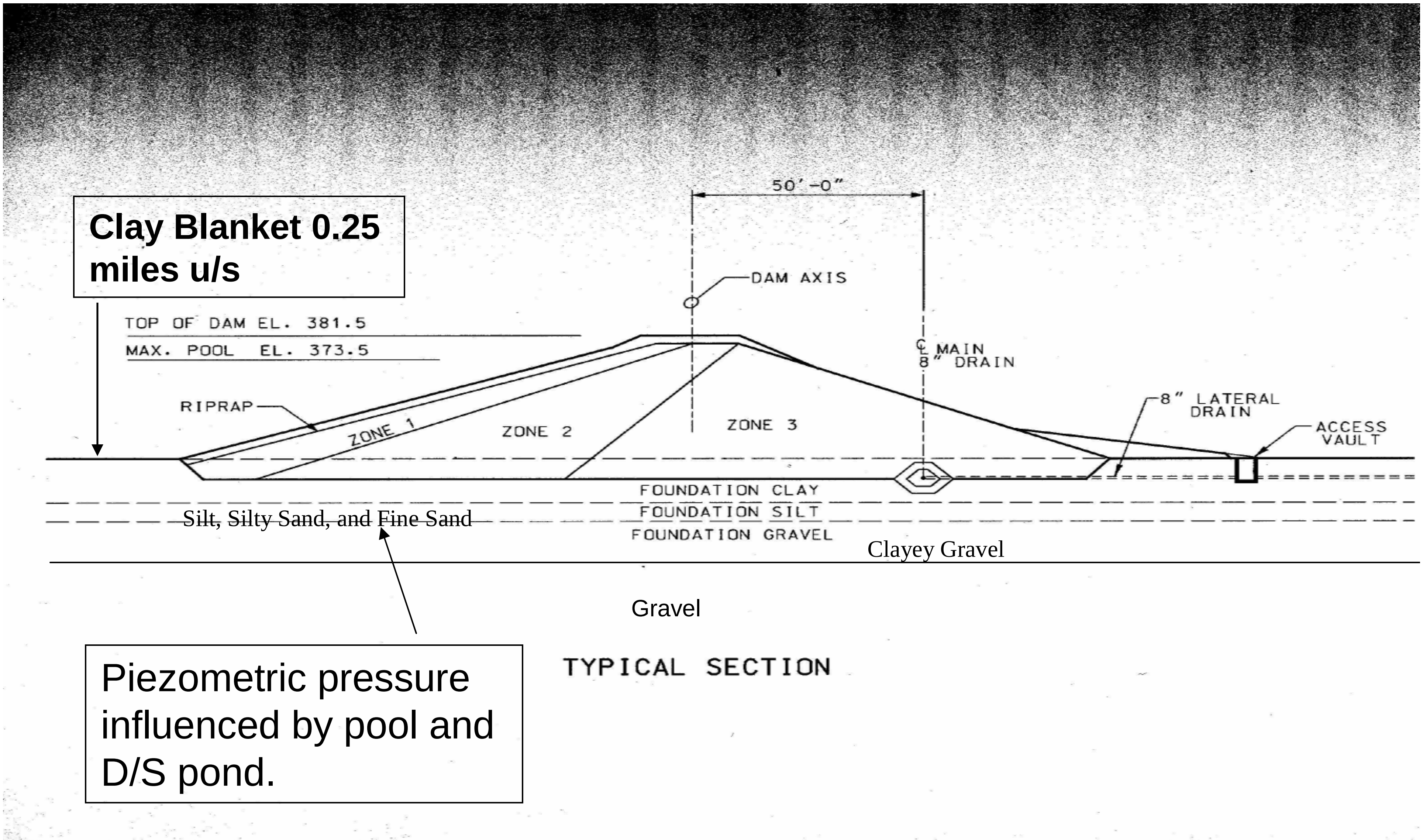
Plan View (Sta. 25+00 – 50+00)



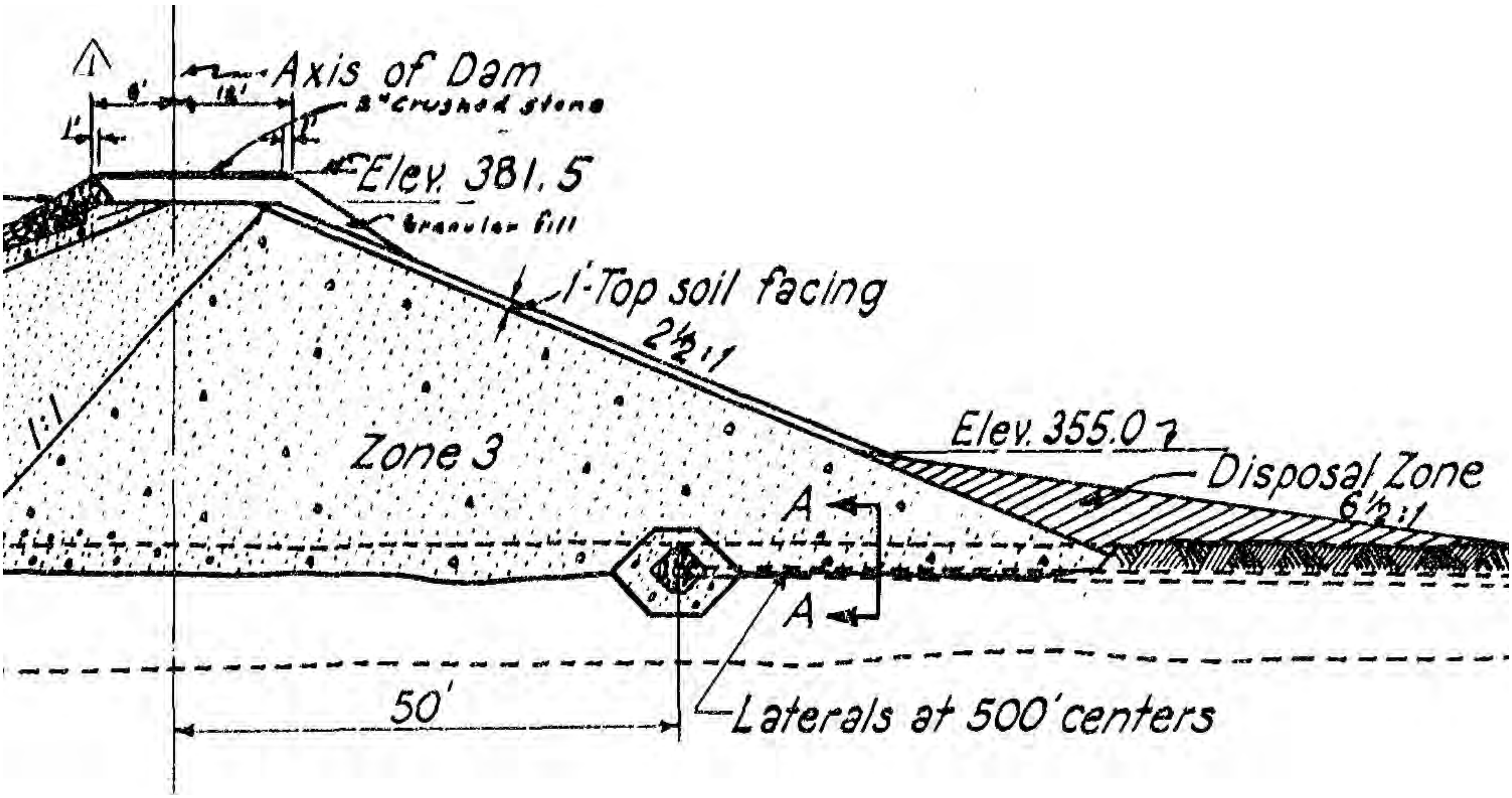
Plan View (Sta. 50+00 – 70+00)



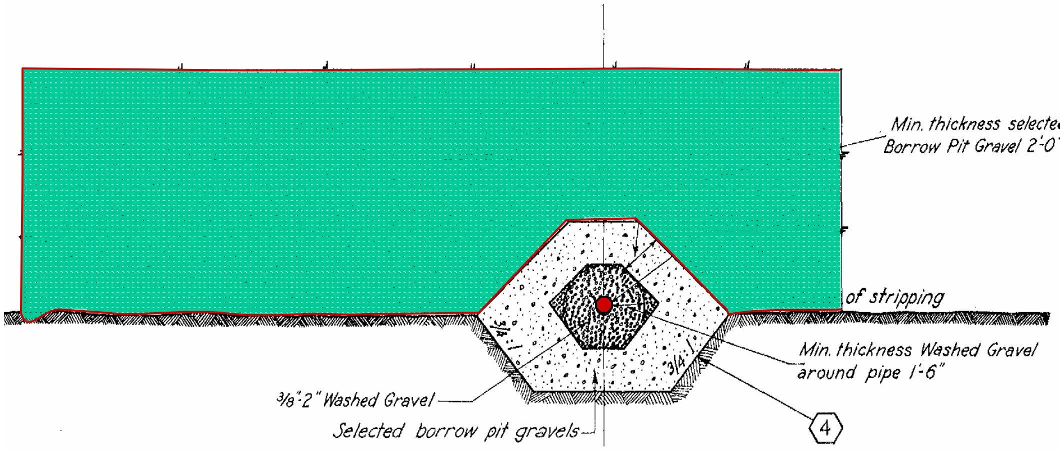
Fern Ridge Cross Section



Details of D/S Embankment Structure



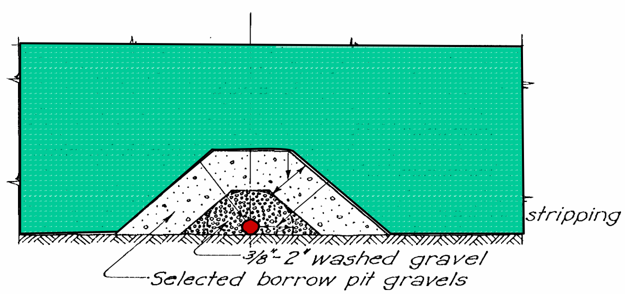
Drain System Details



DRAIN AND FILTER

SCALE: 1/4" = 1'-0"

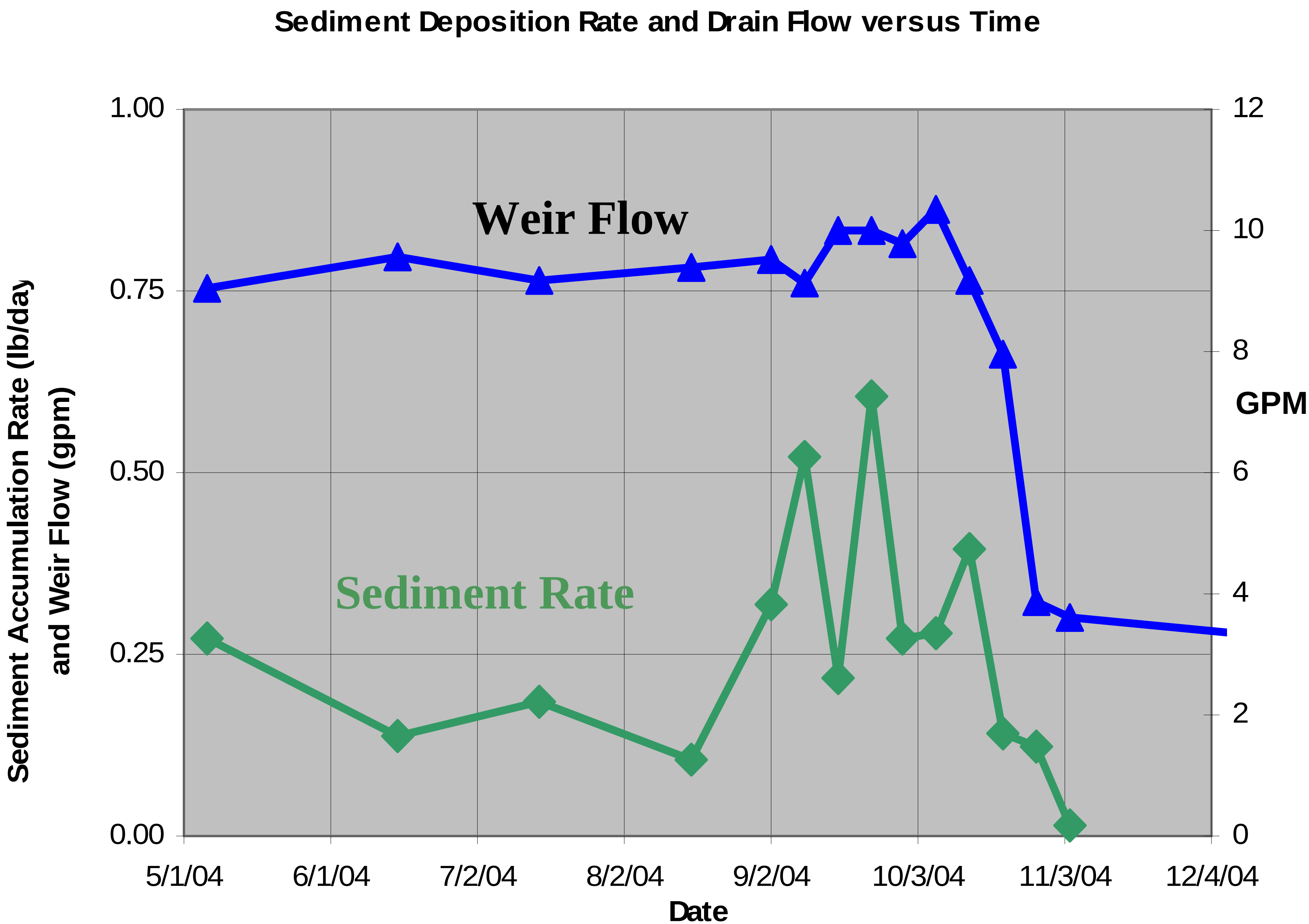
Note:
Pipe shall be 8"-14 gauge corrugated metal with bituminous coating. Main shall be perforated bottom 120° with 3/8" holes @ 1½" centers in valley of corrugations except at joints. Joints shall be ½ circle band, 7" width, riveted to pipe for 1 corrugation. Joints shall be locked by means of an angle iron riveted to abutting sections and bolted. After bolting all parts of joint shall be coated with same bituminous material as pipe. Connections to laterals shall be made with standard tee sections.



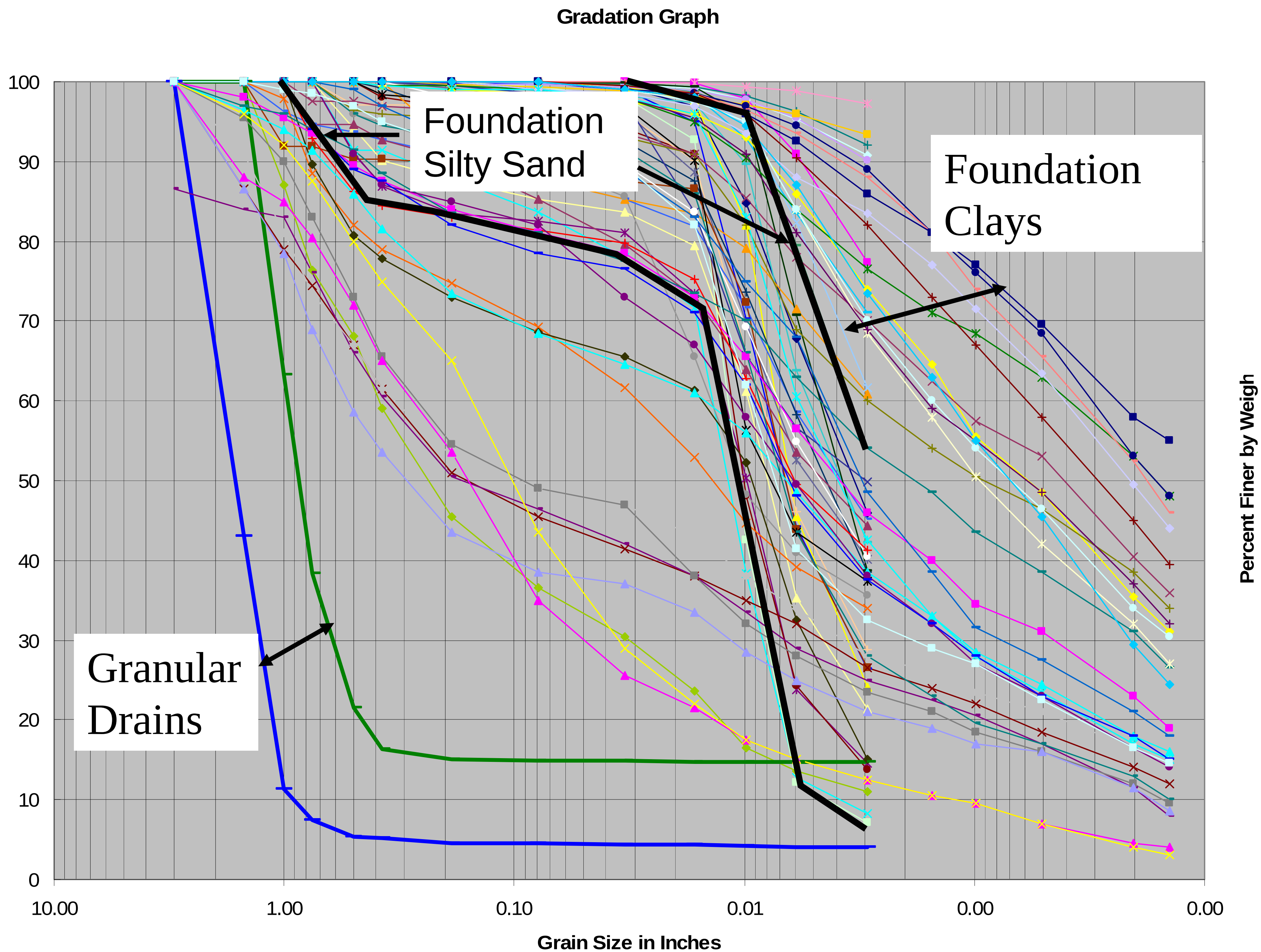
SECTION A-A

SCALE: 1/4" = 1'-0"

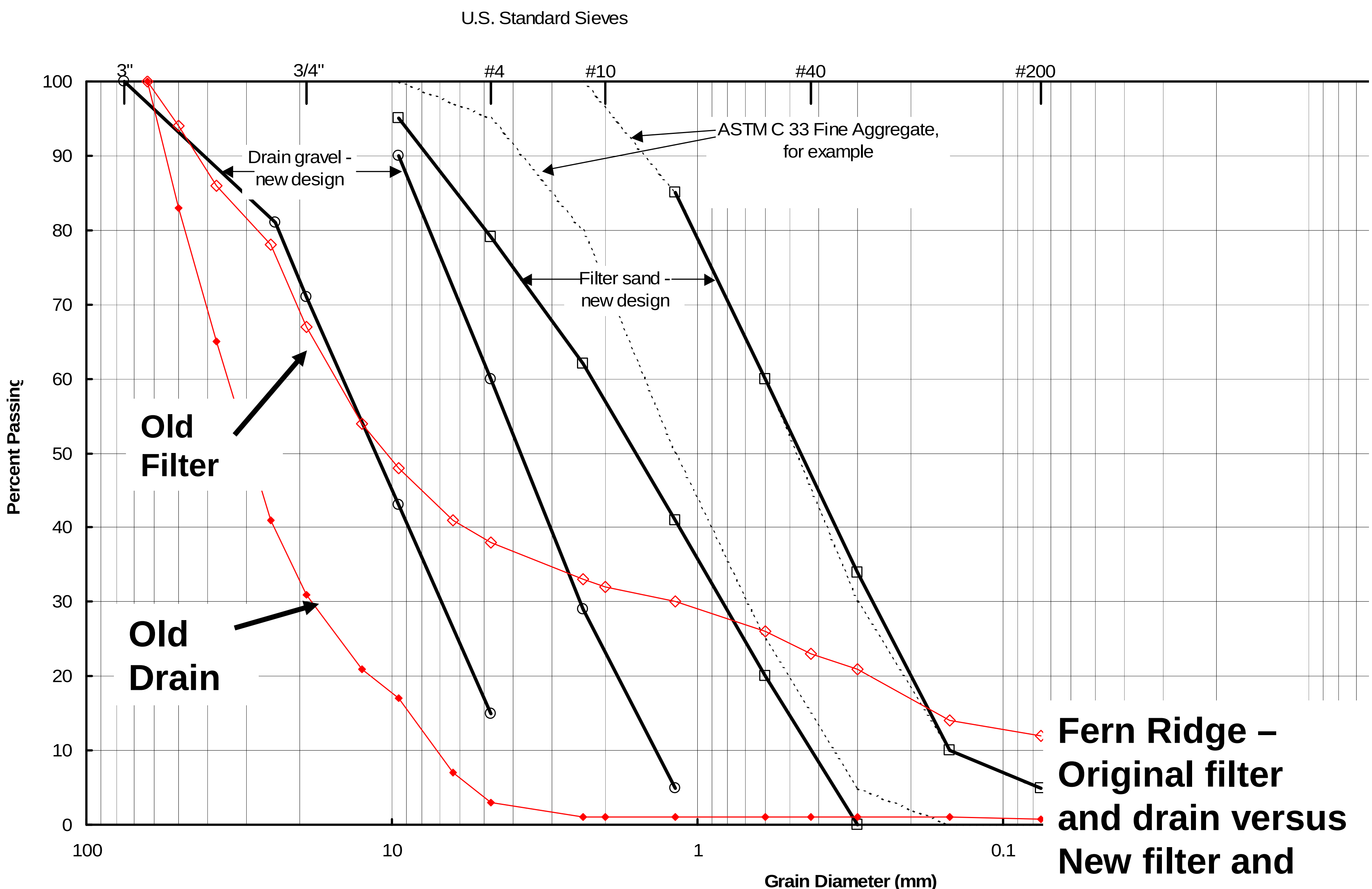
Note:
On the crest of the dam between stations 9+07.75 and 68+80 and stations 2+80 and 5+90.5 a 4" thick top coarse (49) shall be placed.



Sediment Deposition Rate and Drain Flow versus Time
Weir Flow
Sediment Rate
Sediment Accumulation Rate (lb/day
and Weir Flow (gpm)
1.00
0.75
0.50
0.25
0.00
12
10
8
6
4
2
0
GPM
5/1/04
6/1/04
7/2/04
8/2/04
9/2/04
10/3/04
11/3/04
12/4/04
Date



Gradation Graph
100
90
80
70
60
50
40
30
20
10
0
10.00
1.00
0.10
0.01
0.00
0.00
Grain Size in Inches
Percent Finer by Weigh
Foundation Silty Sand
Foundation Clays
Granular Drains



Fern Ridge – Original filter and drain versus New filter and drain design.

Station 14+40

At Pool Elev 373.5 (Max. Cons. Pool)

For Foundation Piping/Erosion FM

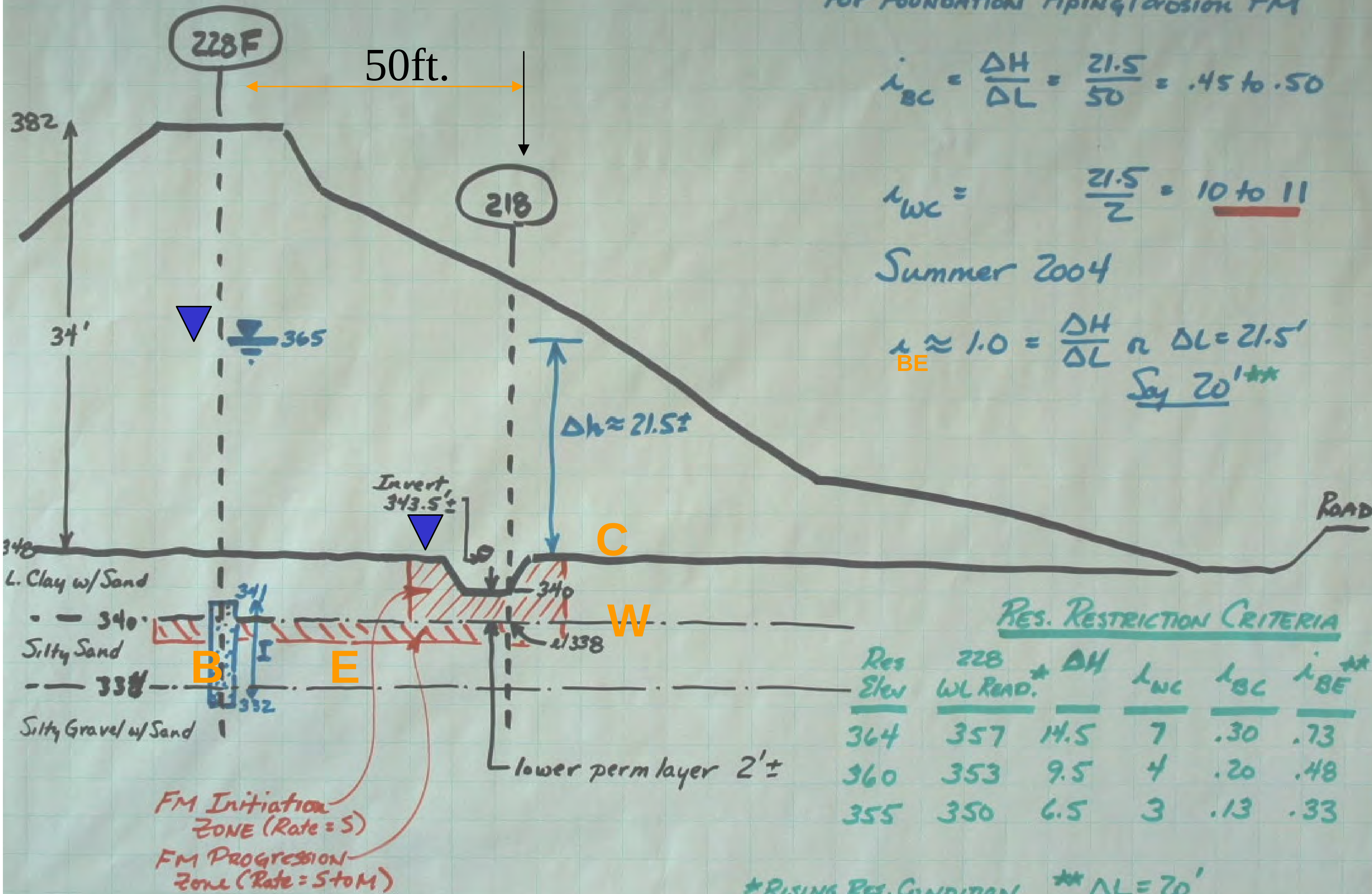
$$i_{BC} = \frac{\Delta H}{\Delta L} = \frac{21.5}{50} = .45 \text{ to } .50$$

$$i_{WC} = \frac{21.5}{2} = 10 \text{ to } 11$$

Summer 2004

$$i_{BE} \approx 1.0 = \frac{\Delta H}{\Delta L} \therefore \Delta L = 21.5'$$

Say 20'**

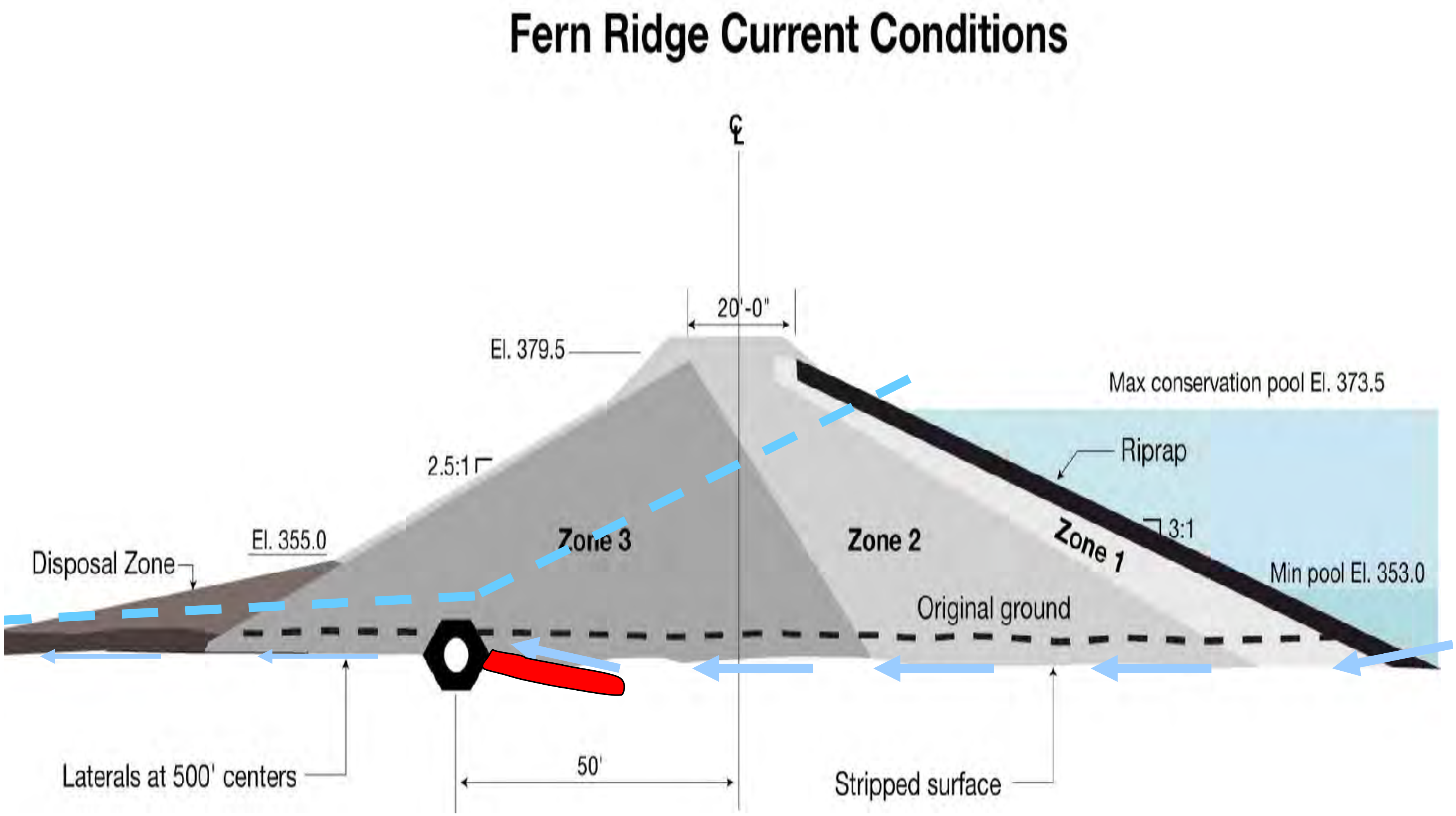


Res. Restriction Criteria

Res Elev	228 WL Read.*	ΔH	i_{WC}	i_{BC}	i_{BE}**
364	357	14.5	7	.30	.73
360	353	9.5	4	.20	.48
355	350	6.5	3	.13	.33

*Rising Res. Condition ** ΔL = 20'

Continuation of Piping Failure



Questions?

U.S. Army Corps
of Engineers

Status of Portfolio Risk Assessment

Eric Halpin, PE
Special Assistant for Dam Safety
HQ US Army Corps of Engineers
August 2005

U.S. Army Corps of Engineers

Purpose

- **Describe Program Management Plan for Implementing Risk and Reliability:**
  - **Scope of Work (Reservoir & Navigation Dams)**
  - **Roles & Responsibilities**
  - **Budget**
  - **Schedule**

U.S. Army Corps of Engineers

Scope of Work

General Objectives	Team & Leader
Ways: **Tools & Methods**	**Methodology Team** ***Anjana Chudgar***
Ways: **Policy & Planning**	**Dam Safety Steering Committee** ***Charles Pearre***
Means: **Human and Financial Resources**	**Program Management Team** ***Andy Harkness***
Ends: **Oversight & Decisions**	**Senior Oversight Group** ***Eric Halpin***

U.S. Army Corps of Engineers

Senior Oversight Group

- Team Members:
  - Eric Halpin, Leader
  - Harry Kitch, HQ
  - Barry Holliday, HQ
  - Programs, HQ
  - Bruce Murray, LRL
  - Tommy Schmidt, SWD
  - John Bianco, NAD
  - Jeff Schaefer, LRL
  - Dave Schaaf, LRL
  - Jeff McClenatham, NWO
  - Jerry Webb, HQ

- Specific Objectives:
  - Overall Planning and Oversight of Other Teams
  - Annual Interpretation & Recommendations from Risk Assessments
  - Strategic & Operational Guidance on:
    - Policy
    - Methods
    - DS Program Changes
    - Long Term Management & Staffing Approach

U.S. Army Corps of Engineers

Methodology Team

- **Team Members:**
  - **Anjana Chudgar, HQ Lead**
  - **USBR Representative**
  - **Dr. David Bowles**
  - **Cadre Representatives (3)**
  - **HQ E&C CoP Leader**
  - **MSC Representative**
  - **Wayne Jones, ERDC**
  - **Mike Grounds, DSPMT**
- **Objectives:**
  - **Update & Revise SPRA Tool as necessary**
  - **Develop PRA Tool Using USBR Method as Template**
  - **Provide Recommendations to Policy Team**
  - **Develop Site Specific Risk Assessment Tool**

U.S. Army Corps of Engineers

Policy & Planning Team

- **Team Members:**
  - Charles Pearre, HQ Leader
  - Rob Taylor, LRD
  - Milt Meyers, ERDC
  - Laila Berre, NWD
  - Dan Rodriguez, NAD
  - Dwayne Lillard, SPA
  - Duane Stagg, MVD
  - Bob Fulton, SAD
  - Tats Hirata, POD
  - Sue Gehrt, NWK
  - Brent Trauger, SAJ

- **Specific Objectives:**
  - Complete Review and Edits on SPRA ETL
  - Develop ETL on PRA Methodology
  - Re-Engineer USACE Dam Safety Program with Risk and Reliability Approach:
    - Periodic Inspections
    - Instrumentation
    - Training
    - Exercises
    - EAPs

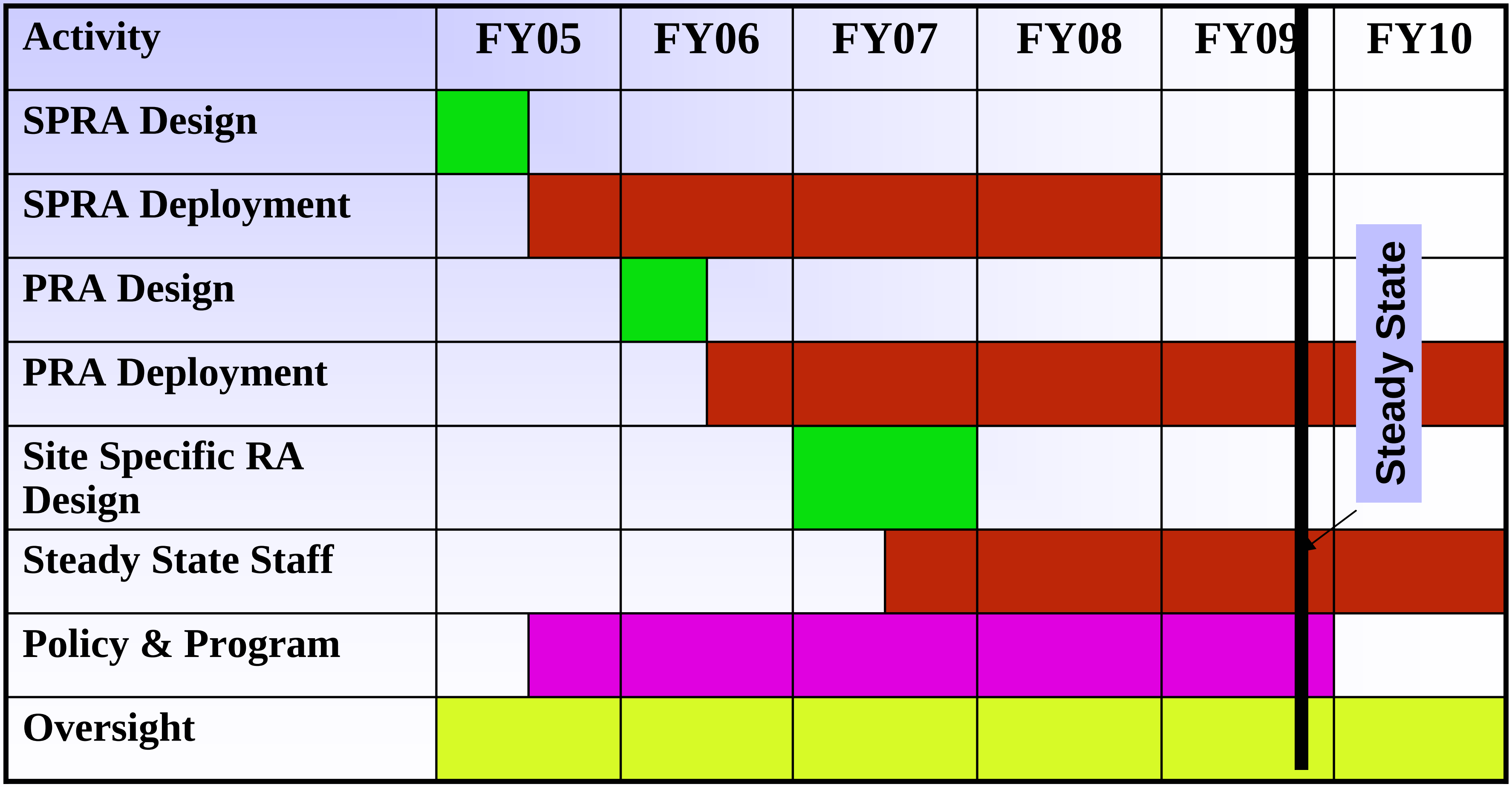
U.S. Army Corps of Engineers

Program Management Team

- Team Members:
  - Andy Harkness, Lead LRP
  - Charles Pearre, HQ
  - Operations CoP, HQ
  - Operations CoP, District
  - Joseph Bittner, HQ
  - Michael Jordan, SWG
  - Mark Mugler, ASA Advisor
- Specific Objectives:
  - Budget, Manage, and Execute Required Funding of All R&R Activities
  - Coordinate and Develop All Human Resources
  - Schedule and Coordinate All Major Program Milestones
  - Manage All Outsourced Support
  - Manage ITR and Peer Review Efforts

U.S. Army Corps
of Engineers

Program Schedule



U.S. Army Corps of Engineers

Budget

- **FY05: $1.62 M**
- **FY06: $ 3.55 M Requested and Being Justified/Briefed**
- **FY07: $ 4.3 M Being Justified/Briefed**
- **FY08 and Beyond: To be Determined by Program Management Team**

TRUST

SPL

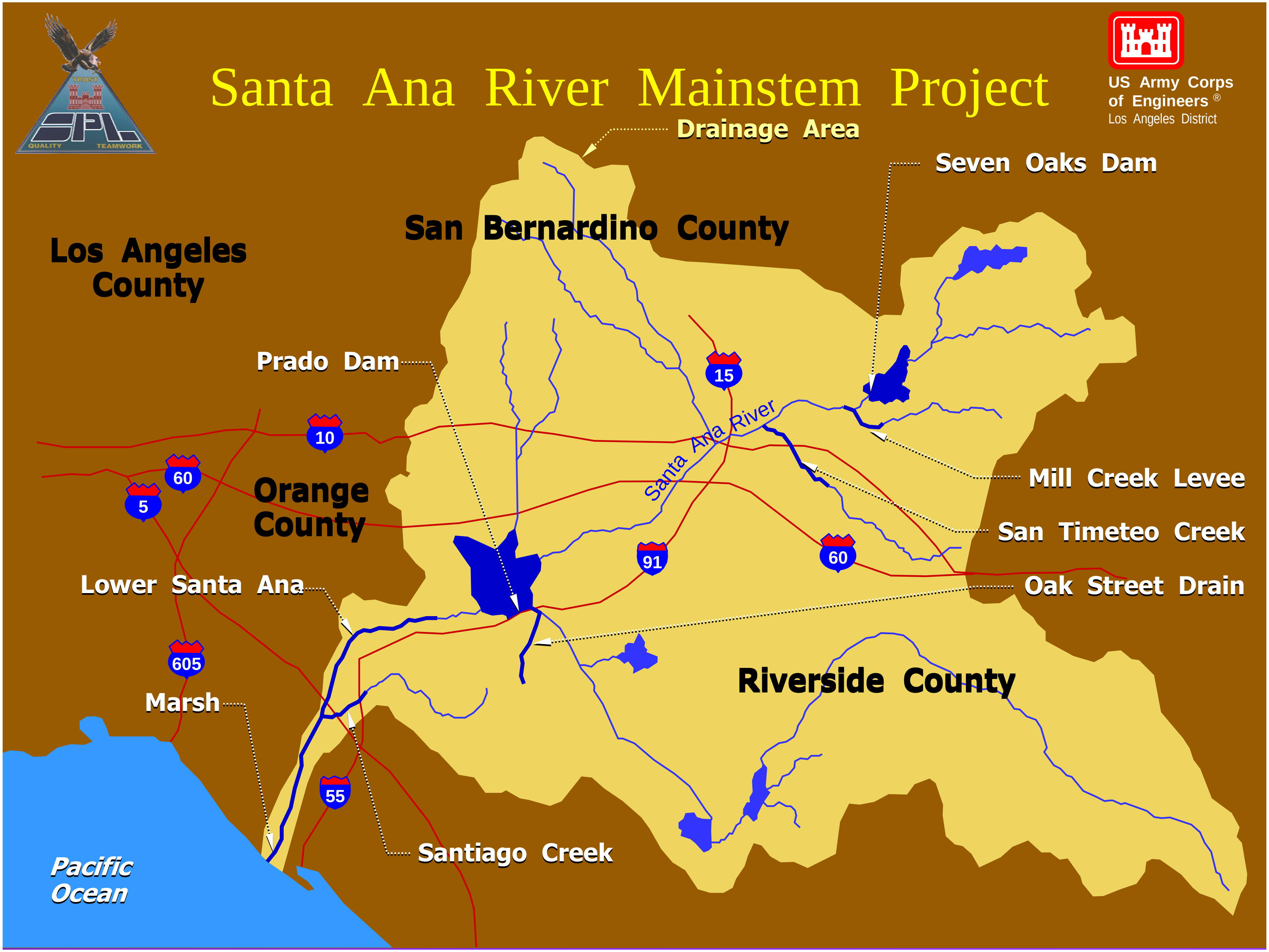
QUALITY TEAMWORK

US Army Corps of Engineers

Los Angeles District

Portland District

SEVEN OAKS DAM
Outlet Tunnel Invert Damage



Santa Ana River Mainstem Project
Drainage Area
US Army Corps of Engineers ®
Los Angeles District
SPL
TRUST
QUALITY
TEAMWORK
Seven Oaks Dam
San Bernardino County
Los Angeles County
Prado Dam
15
10
Santa Ana River
60
5
Orange County
Mill Creek Levee
San Timeteo Creek
91
60
Lower Santa Ana
Oak Street Drain
605
Riverside County
Marsh
55
Santiago Creek
Pacific Ocean

Seven Oaks Dam

- Authorized under WRDA 1986, 99th Congress 2nd Session, P.L. 99-662
- Flood Control Purpose
- Operate in Tandem with d/s Prado Dam
- Non-Federal Sponsors:

  Orange County Flood Control District

  San Bernardino County Flood Control District

  Riverside County Flood Control and Water Conservation District

Seven Oaks Dam

Seven Oaks Dam
Pertinent Data

River	Santa Ana River
County and State	San Bernardino County, California
Purpose	Flood Control
Drainage Area	177 mi2
Type	Rolled, zoned, earth and rockfill
Crest elevation (excluding overbuild)	2,610 feet, NGVD
Foundation elevation at dam axis	2,060 feet, NGVD
Maximum height above foundation at dam axis	550 feet
Freeboard	5.3 feet
Crest length	2,760 feet
Crest width	40 feet
Crest overbuild	varies from 0 to 3 feet
Downstream	1.8H to IV
Upstream	2.2H to IV
Total embankment volume	38,372,510 cubic yards

Seven Oaks Dam
Pertinent Data

• Debris pool (year 1)	2,200 feet, NGVD
• Debris pool (year 100)	2,300 feet, NGVD
• Reservoir design flood pool	2,580 feet, NGVD
• Probable maximum flood pool	2,604.7 feet, NGVD

Gross capacity

• Reservoir design flood pool (spillway crest)	147,970 acre-feet
• Probable maximum flood pool	169,177 acre-feet
• Top of dam	174,609 acre-feet

Storage allocation (below spillway crest)

• Flood control	115,970 acre-feet
• Sedimentation (100 year storage)	32,000 acre-feet

Seven Oaks Dam
Pertinent Data

Reservoir design flood (general storm)

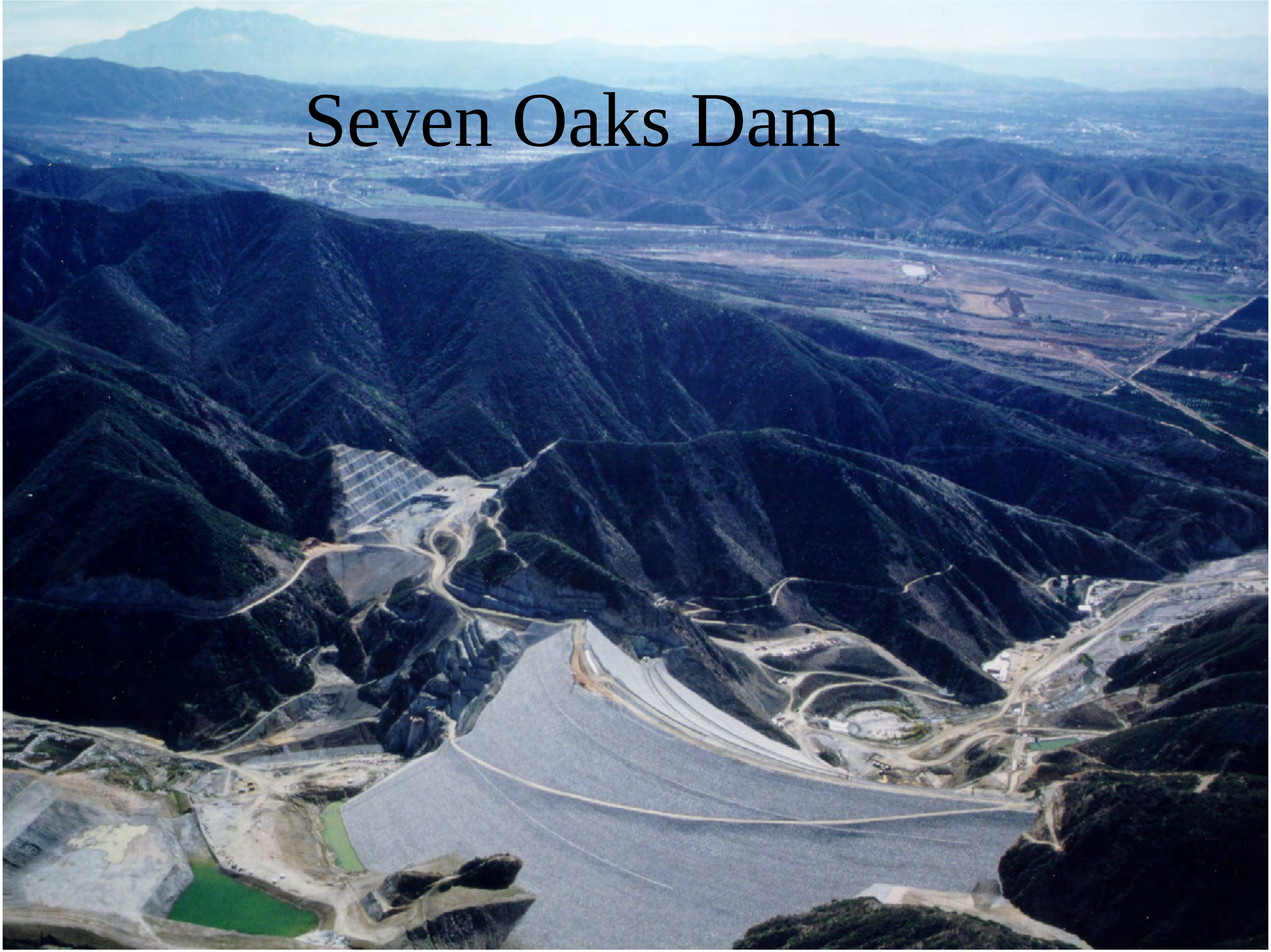
• Total volume (4 day)	115,000 acre-feet
• Peak inflow	85,000 ft3/sec
• Peak outflow	7,000 ft3/sec

Probable maximum flood (general storm)

• Total volume	326,000 acre-feet
• Peak inflow	185,000 ft3/sec
• Peak outflow	180,000 ft3/sec

Chronology

- 1980 Phase I General Design Memorandum
- 1988 Phase II GDM
- 1989 Construction of Pilot Tunnel
- 1991 Partial Intake Structure
- 1992 Diversion Tunnel
- 1999 Dam and Outlet Works
- 2005 High Flow Testing and Tunnel Damage

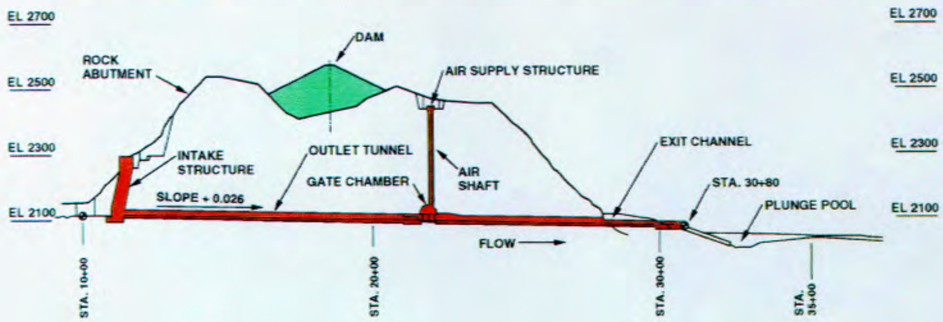

Seven Oaks Dam

SEVEN OAKS DAM

OUTLET WORKS PROFILE

OUTLET WORKS

- 1,600-FOOT LONG TUNNEL
- 200-FOOT HIGH INTAKE STRUCTURE
- 300-FOOT HIGH AIR SHAFT
- GATE CHAMBER
- EXIT CHANNEL
- PLUNGE POOL

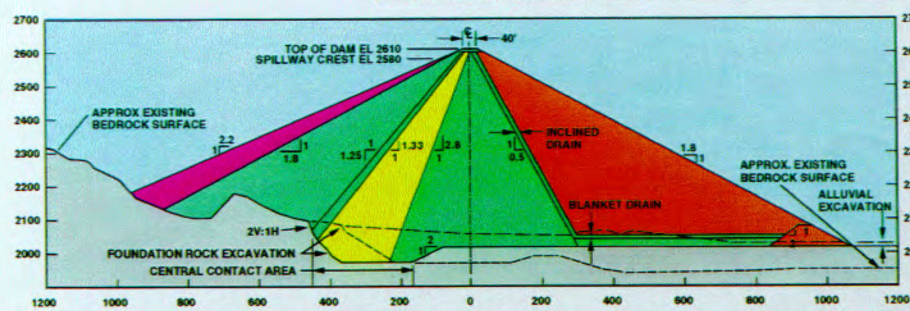


EMBANKMENT CROSS SECTION

DAM

- 550-FOOT HIGH
- 3,000-FOOT LONG
- 40-FOOT WIDE AT CREST
- 2,000 FEET FROM U/S TOE TO D/S DOT

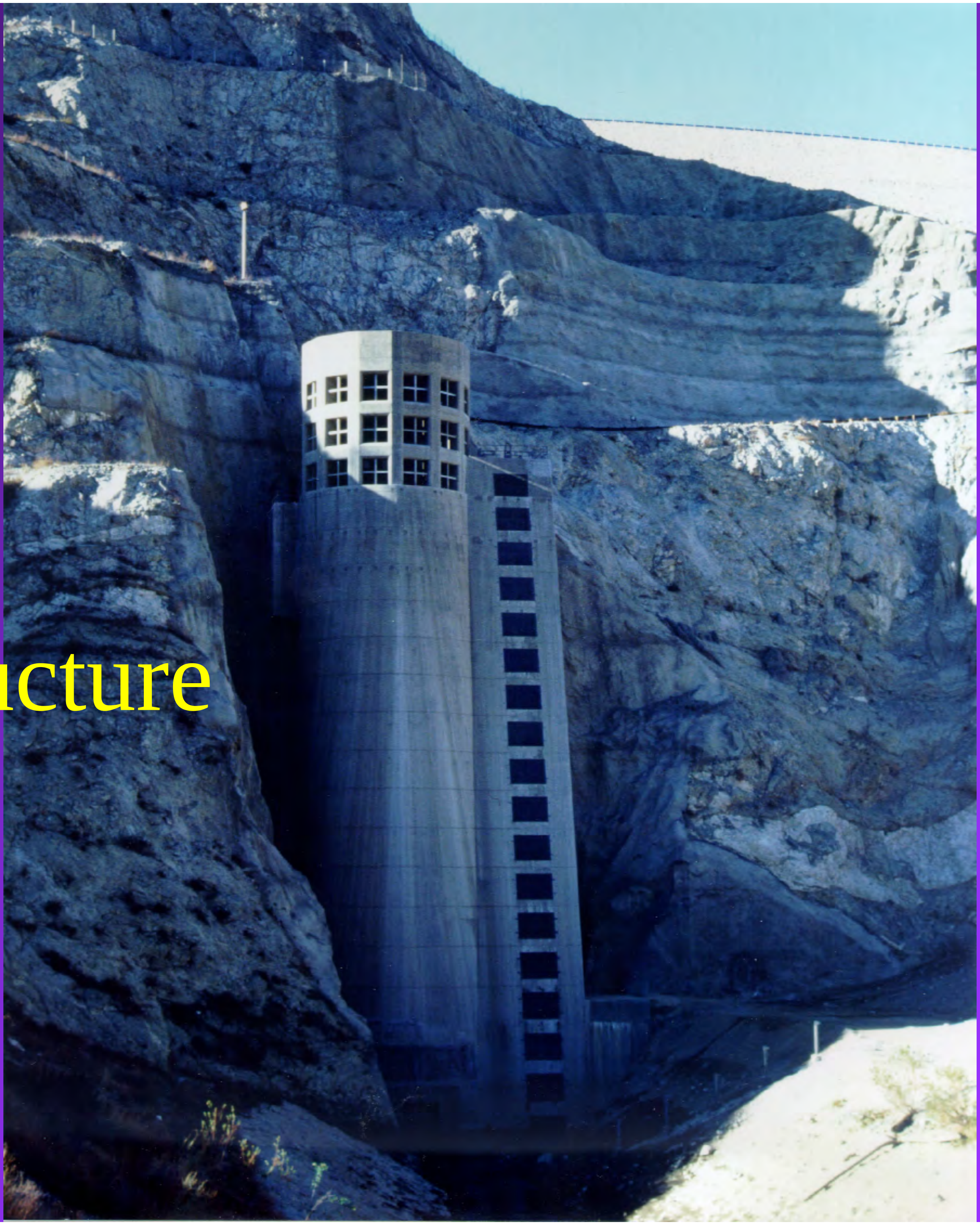
ZONE	PURPOSE
CORE	WATER BARRIER
TRANSITION	DRAINAGE, STABILITY, AND ECONOMICAL USE OF EXCAVATED MATERIALS
ROCKFILL	STABILITY AND ECONOMICAL USE OF EXCAVATED MATERIALS
SHELL	DRAINAGE, EROSION CONTROL, AND STABILITY



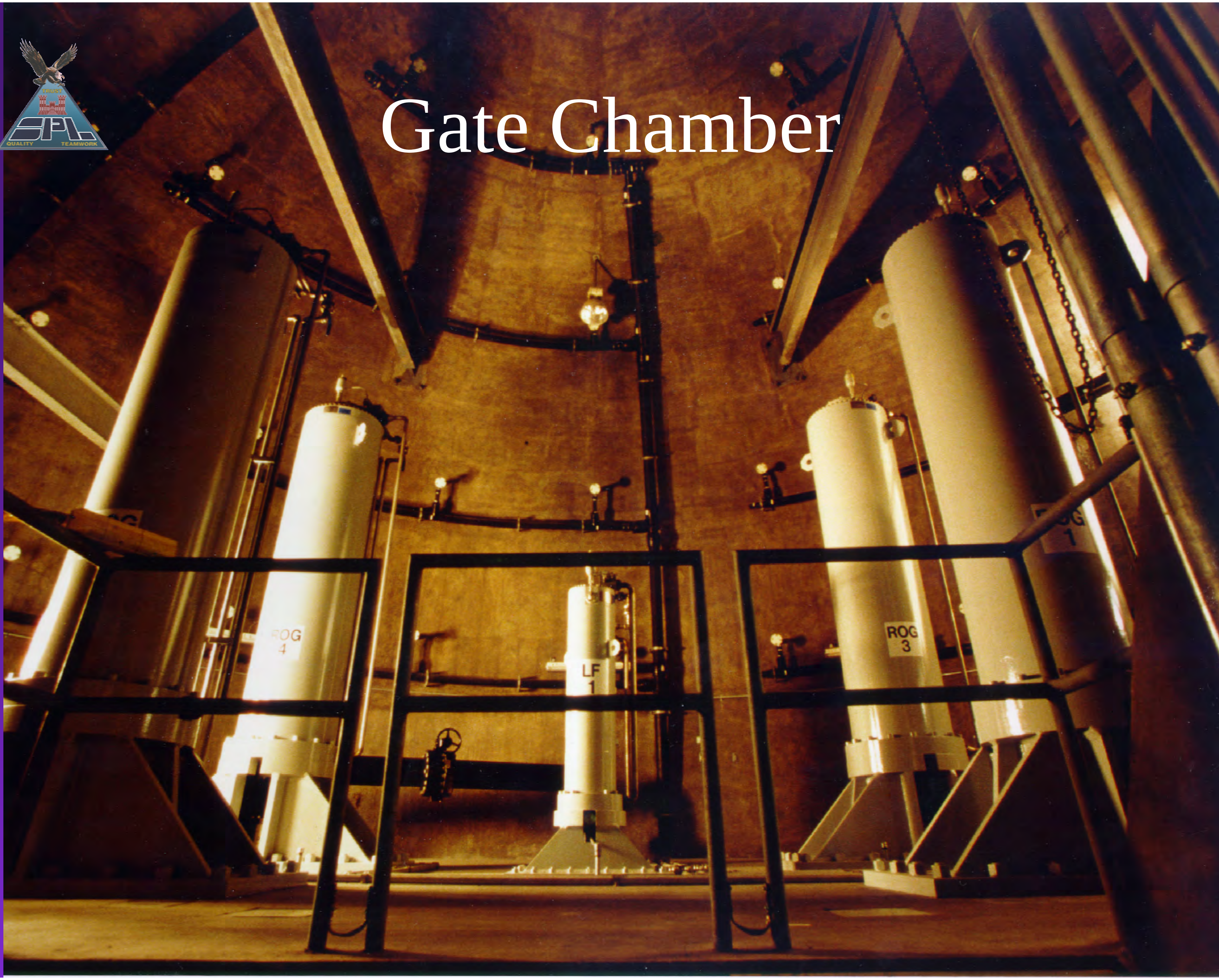
Embankment and

Intake Structure

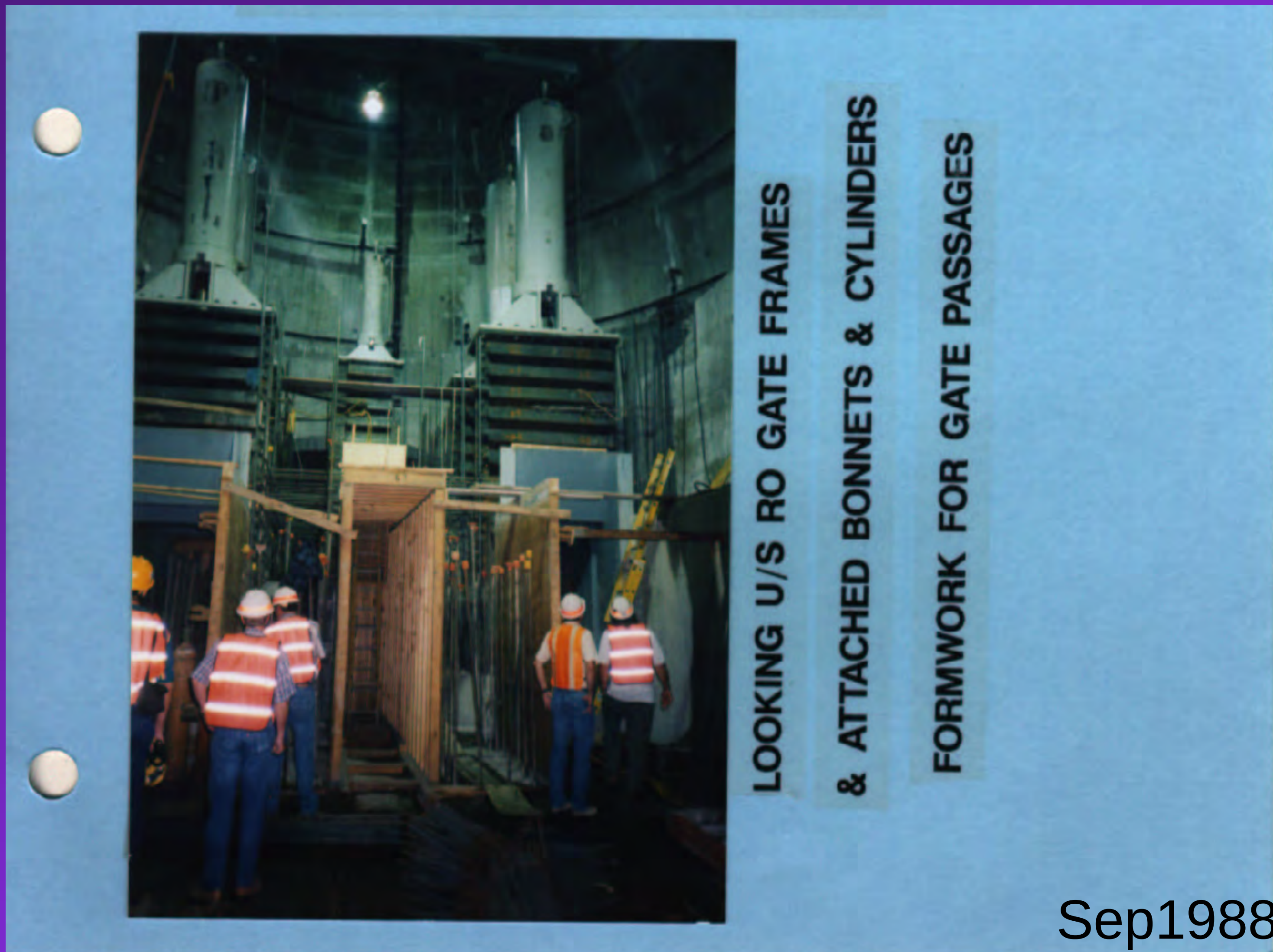
Intake Structure



Gate Chamber



Hydraulic Gates



Sep1988

Access Tunnel

Embankment and Plunge Pool

Hydraulic Design Requirements

- High velocity flow cavitation concern
- 1:25 physical model testing at WES/ERDC
- Flow aeration
- Embed pressure transducers in tunnel for flow testing
- High flow testing to verify design

WATER YEAR PRECIPITATION SUMMARY

Summary by River Basin (% of Historic Average)
For the period Oct 1, 2004 to Jun 30, 2005

	Oct-Jun	Season
• Santa Barbara Area	221	217
• Ventura – Los Angeles Area	236	231
• Santa Ana River	226	217
• San Diego Area	190	183

Ref: California Cooperative Snow Surveys
(http://cdec.water.ca.gov/cgi-progs/iodir/PRECIPSUM.2005)


2301


High Pool El.2392(March 2005)


High Pool El.2392(March 2005)

High Pool El.2392(March 2005)

Hydraulic Testing

Table 1 Testing Schedule and Maximum Discharge Rates

Testing Schedule Feb 17 - Mar 9		Testing Pool (ft)	Range of Gate Openings	Maximum Test Flow Rate (cfs)	Maximum Operational Flow Rate* (cfs)
21-Feb	MDL Test	2373	10%-100%	135	120
22-Feb	MDLE Test	2373	100%	115	100
25-Feb	Low Flow Test	2383	0.25' - 3'	560	700
8-Mar	Right RO Gate Test low Openings	2391	0.5' - 3'	1540	
9-Mar	Right RO Gate Test-High Openings	2392	3.5' - ~~8'~~ 5'	~~3000~~ 2520	4900
~~10-Mar~~	~~Combined RO Gate Test**~~	~~2200~~	~~0.5' - 6.8'~~	~~6600~~	8000

* Maximum Operational Flow Rate is stated in the *Seven Oaks Water Control Manual*, Corps of Engineers, Los Angeles District 2003

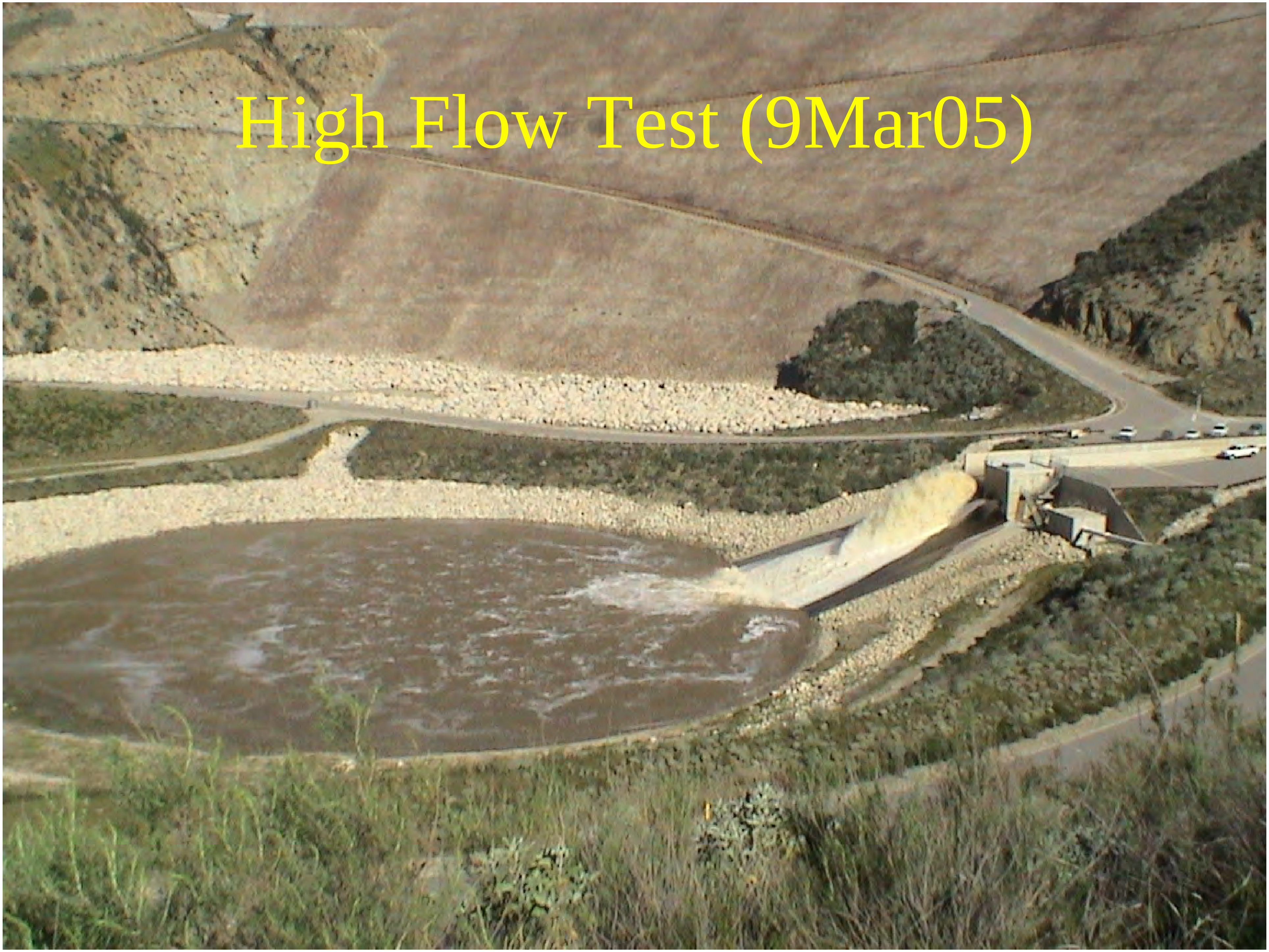
Maximum pool for RO gates is 2580 ft, Maximum pool for MDL and MDLE = 2300 feet

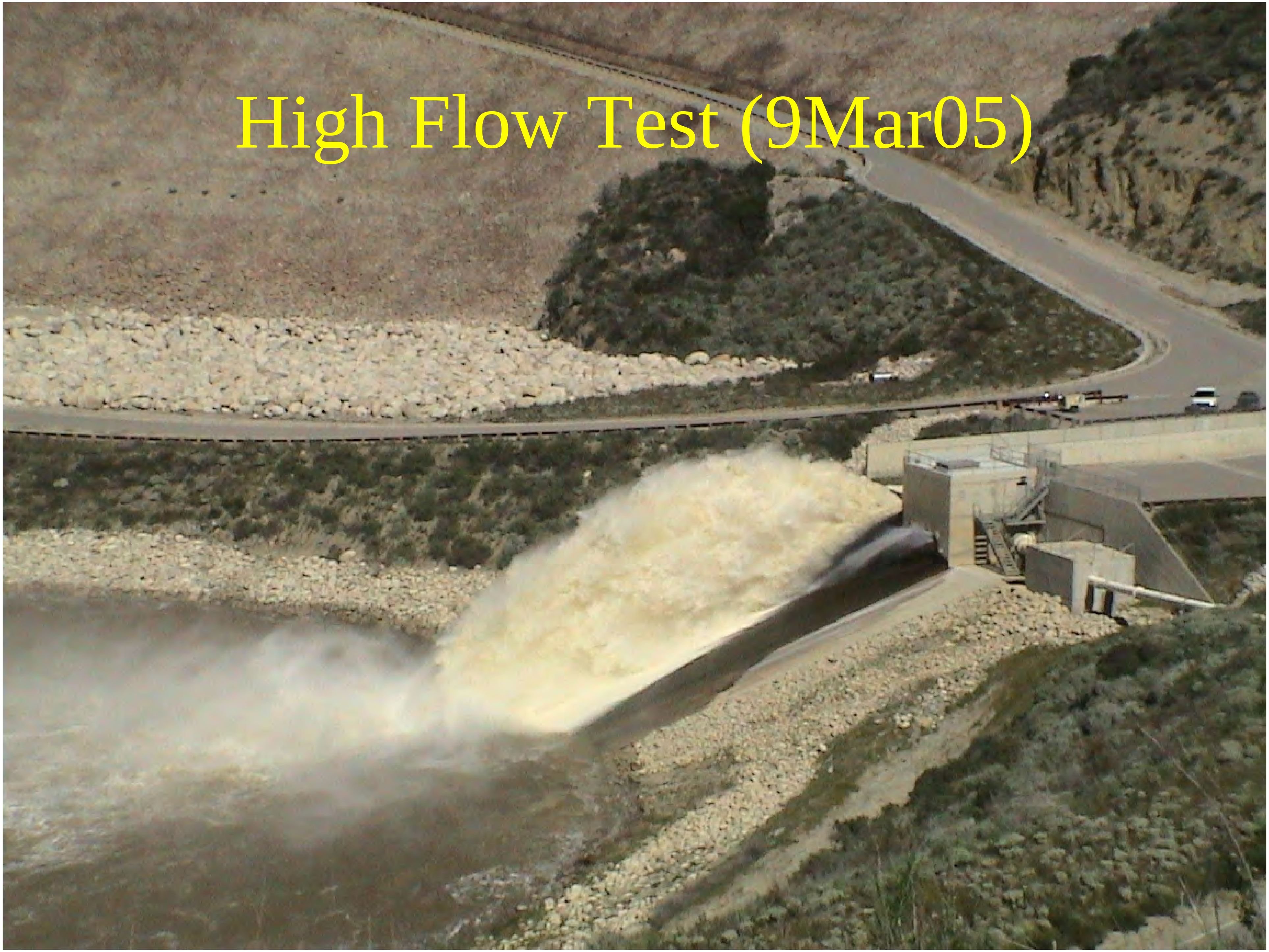
Max. opening for two gate operation = 6.8 feet; max. opening for single gate operation = 8 feet

** stricken items were cancelled due to slab failure

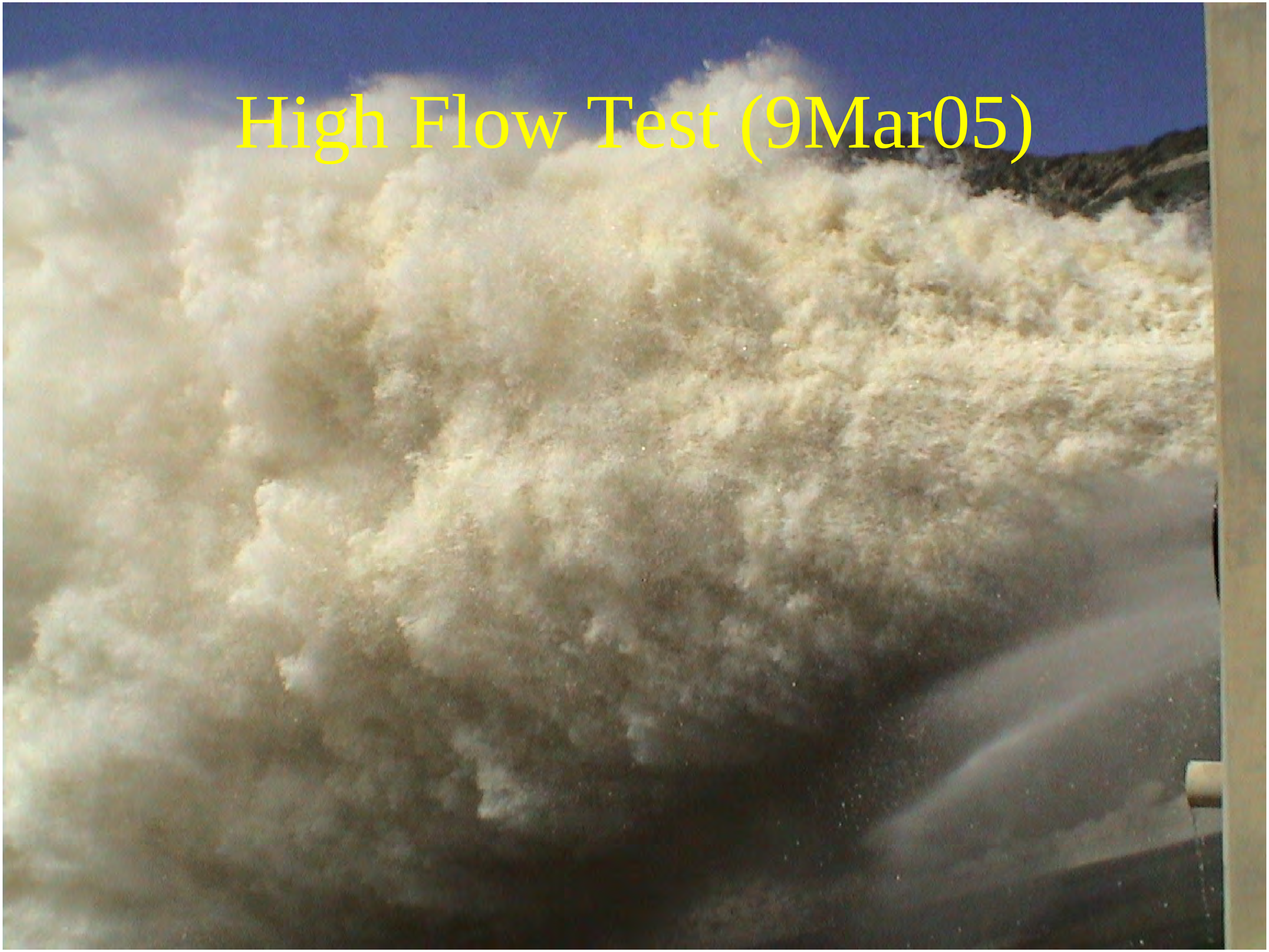

Minimum Discharge Line Flow Test

Cone Valves Flow Jet


High Flow Test (9Mar05)


High Flow Test (9Mar05)

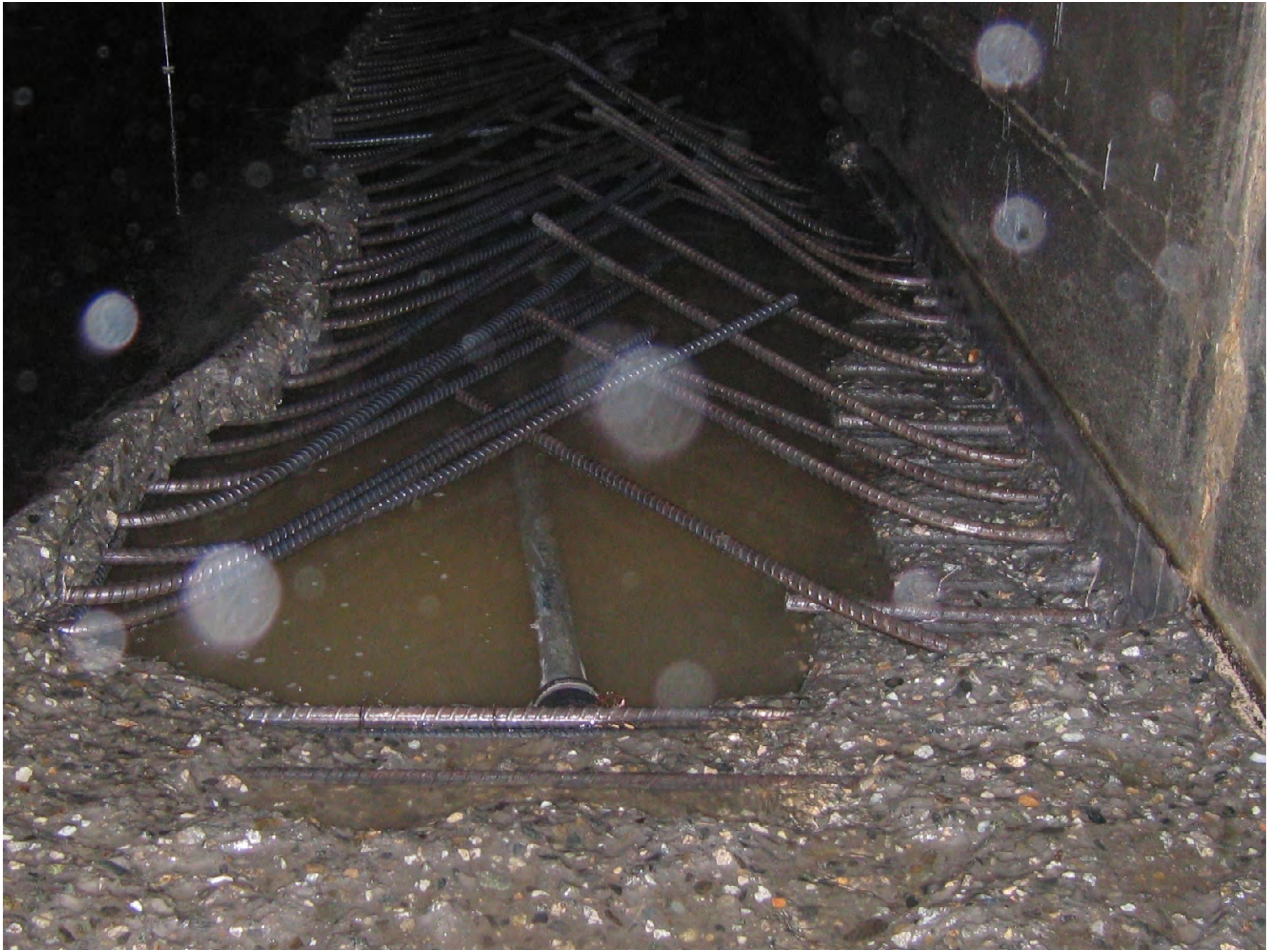
High Flow Test (9Mar05)

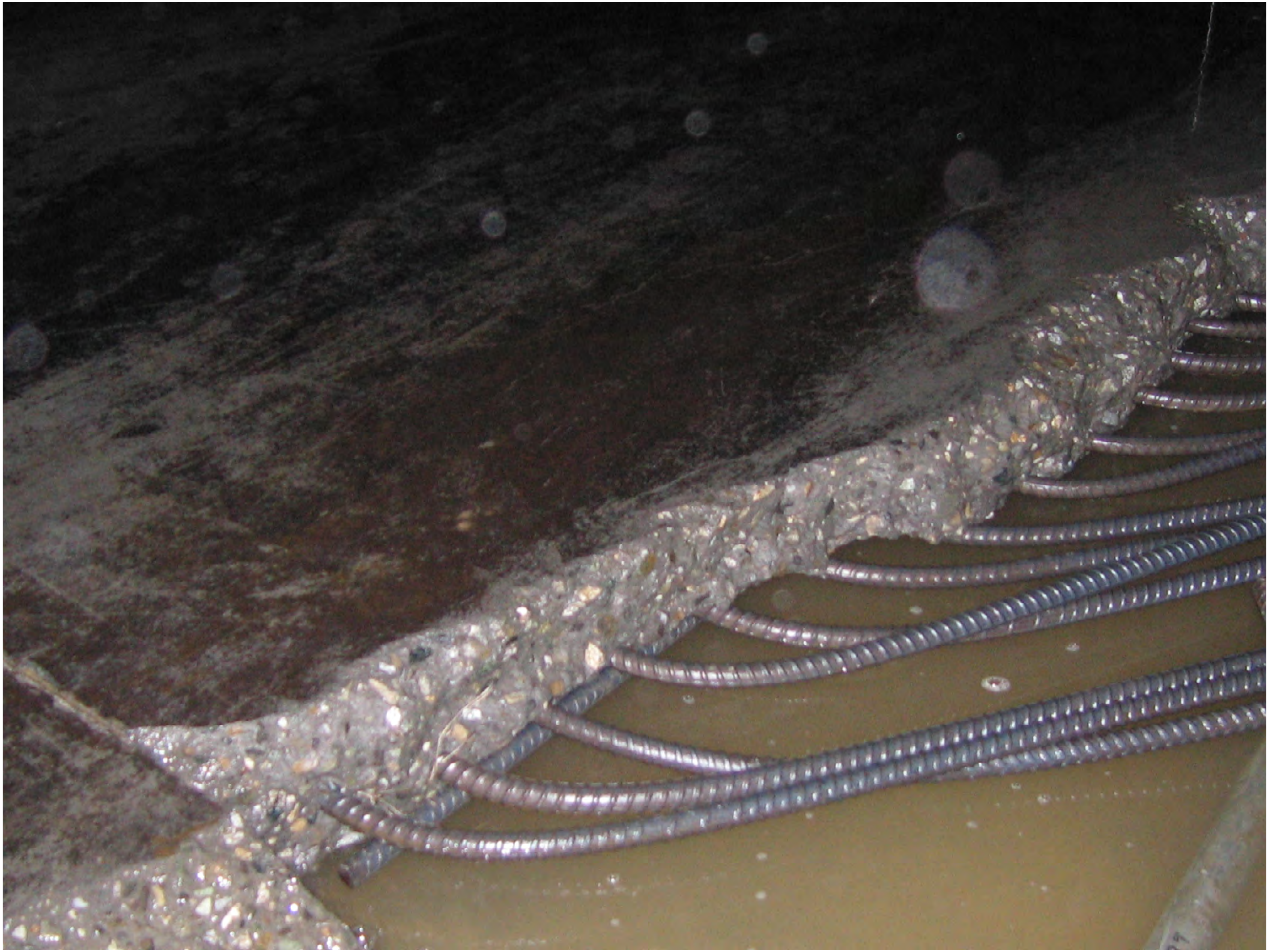


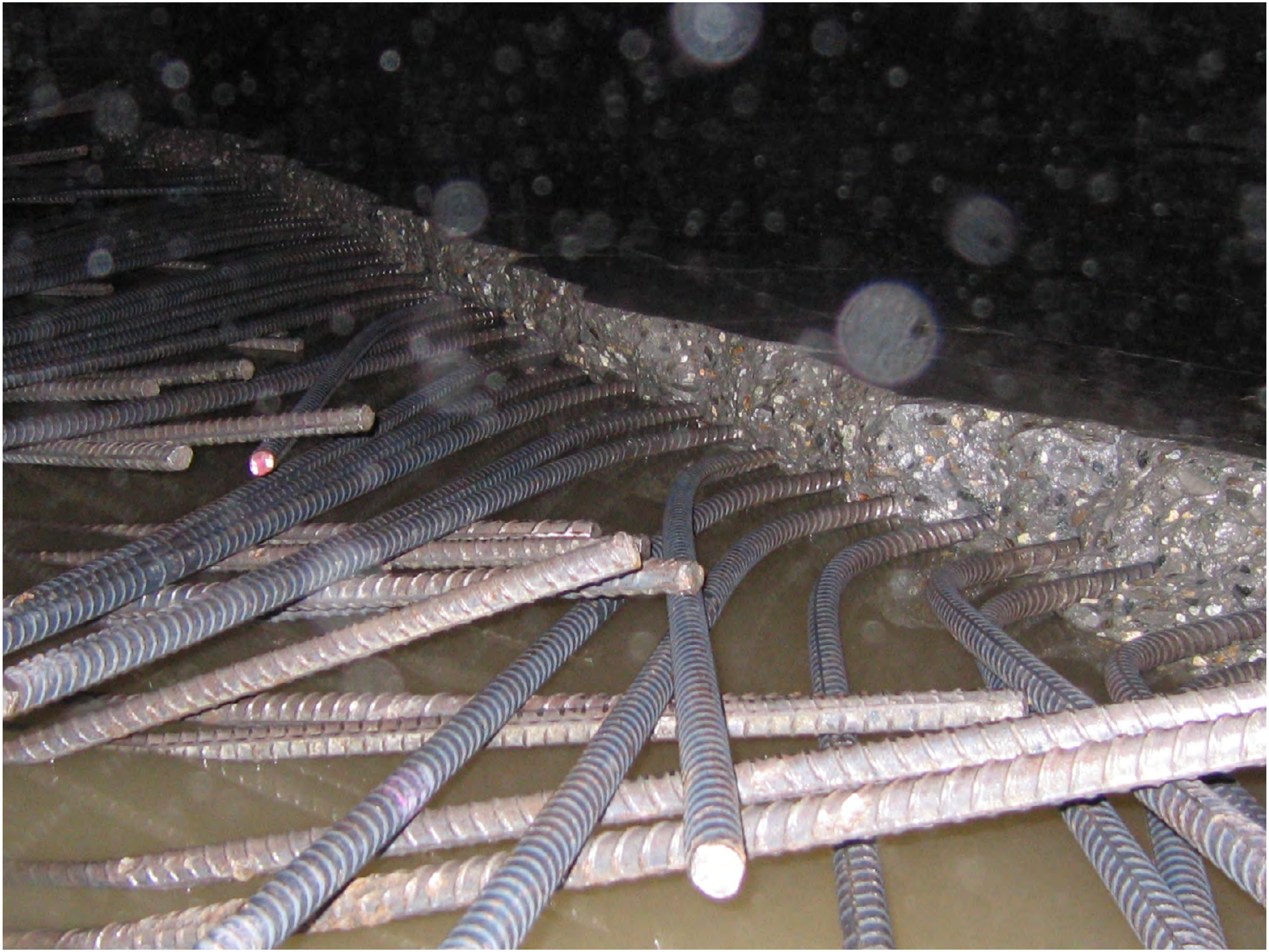
High Flow Test (9Mar05)

High Flow Test (9Mar05)


High Flow Test (9Mar05)







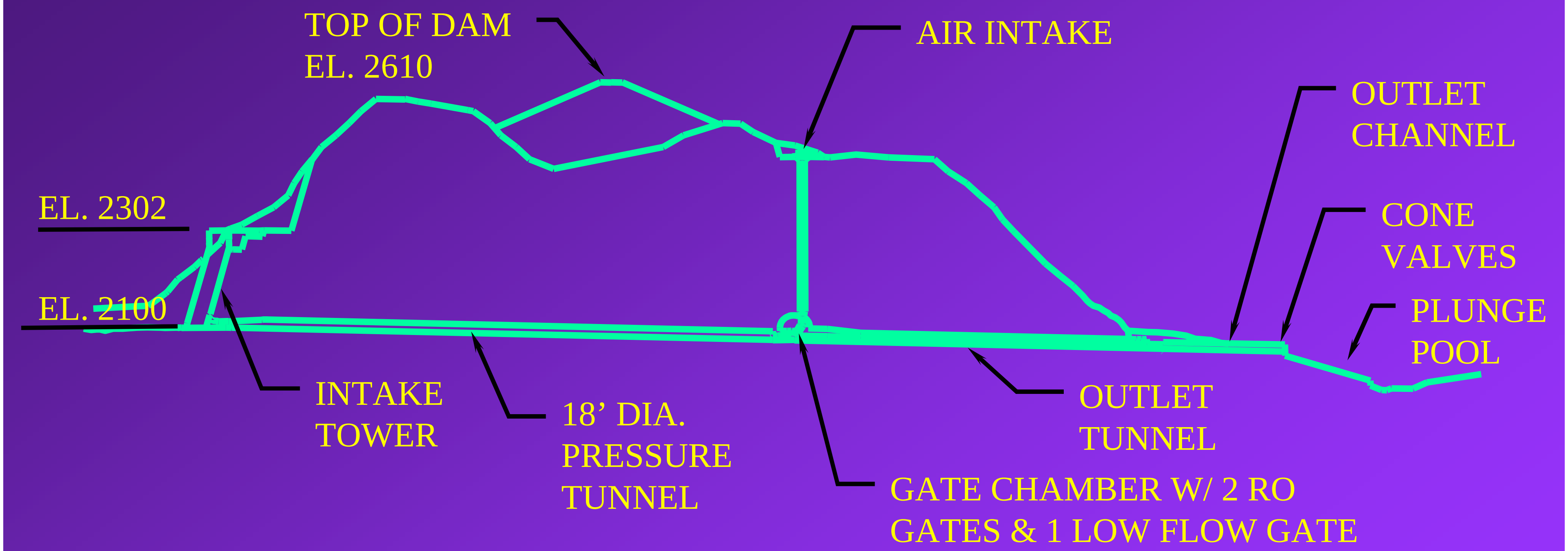
What Happen?

- Was it caused by cavitation?
- Debris impact?
- Groundwater uplift?
- Negative air pressure?
- Differential concrete shrinkage?
- Design deficiency?
- Construction defect?
- Earthquake?

“Just the Facts, Ma’am”

Courtesy of Sgt. Joe Friday
“Dragnet” Detective Drama Series
1952-59,1967-70

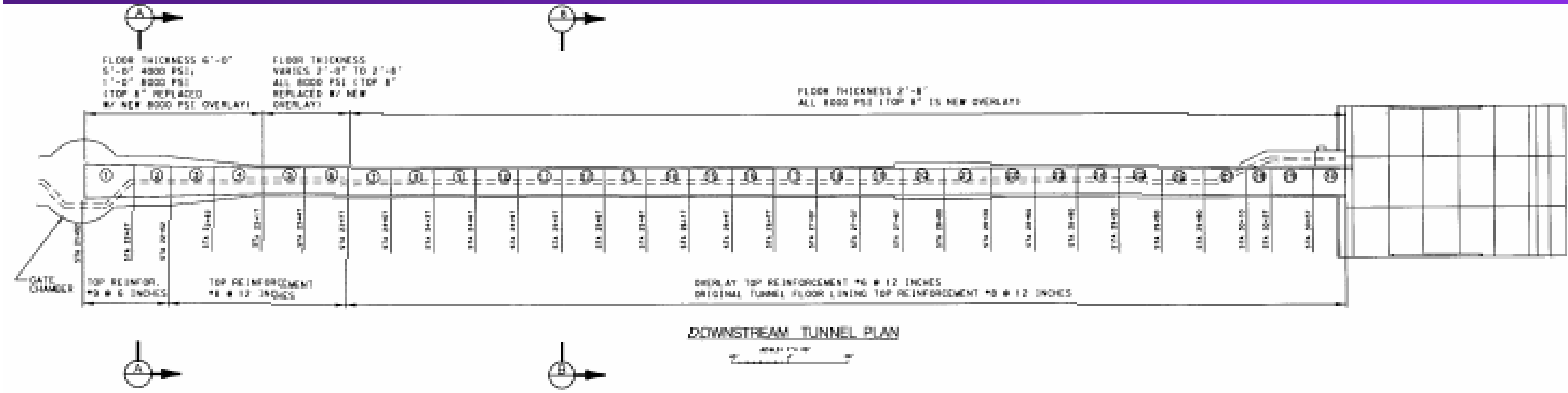
SEVEN OAKS DAM



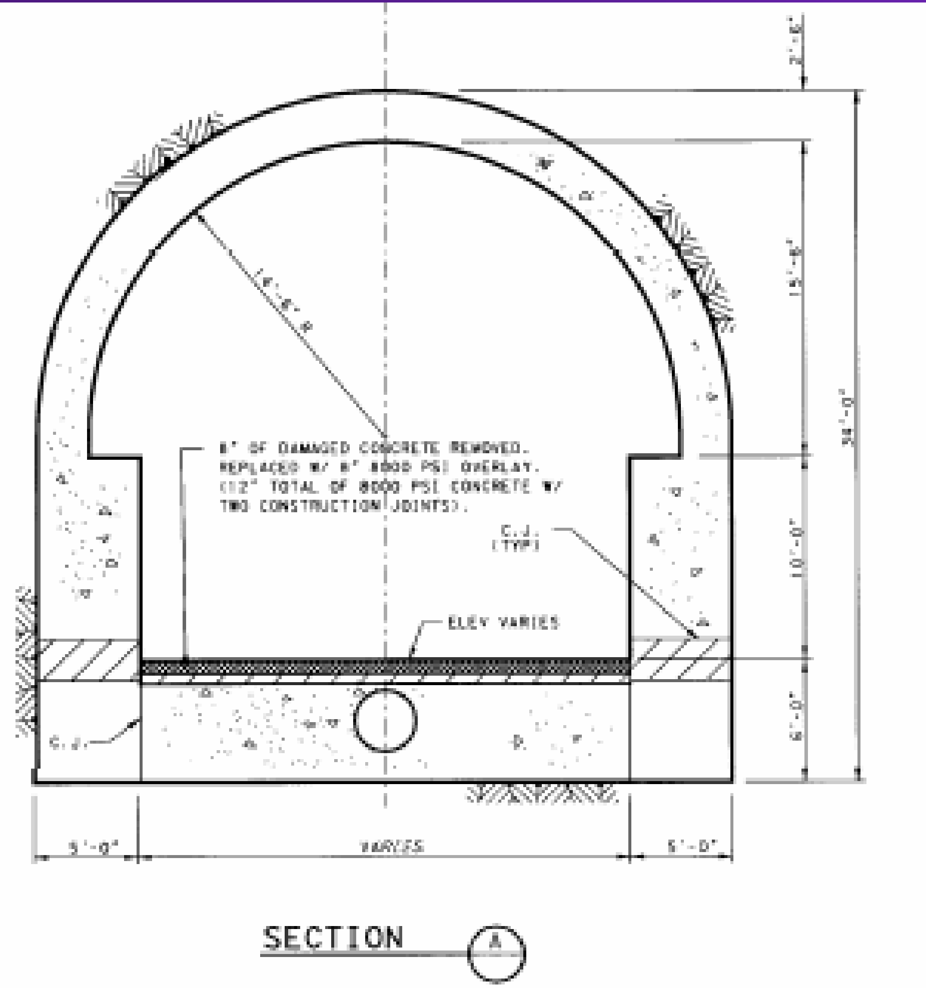
SEVEN OAKS DAM

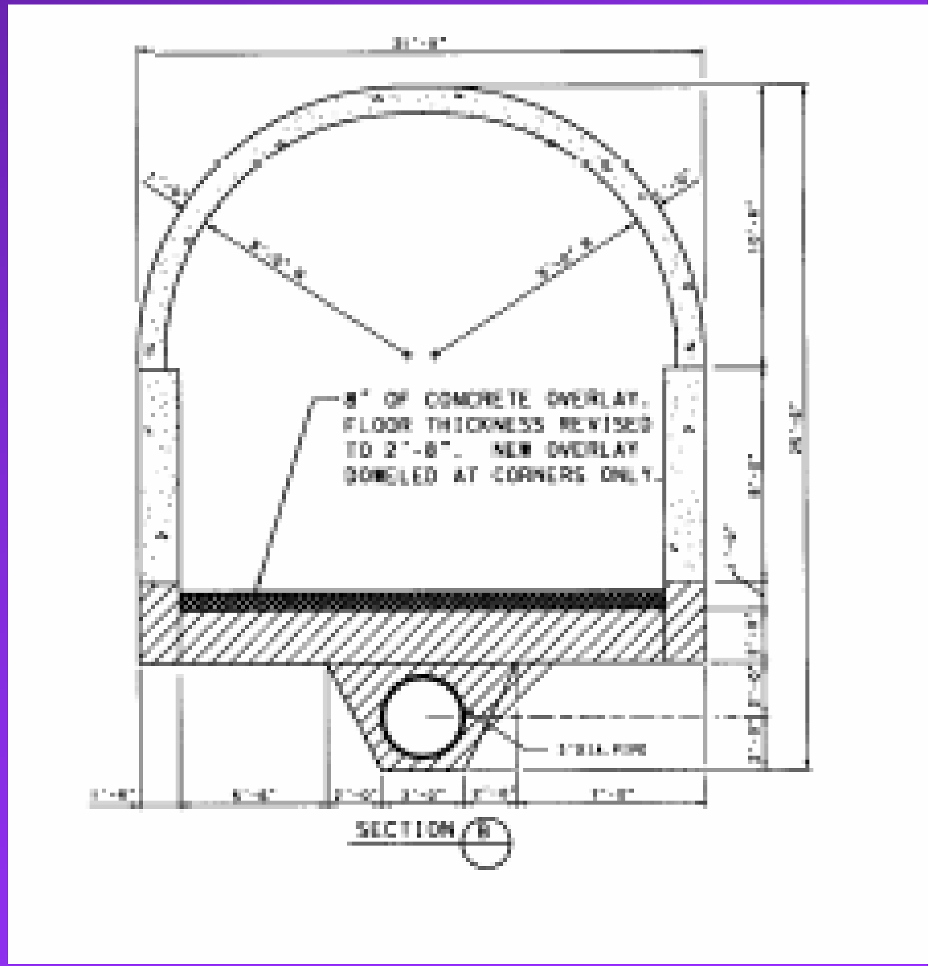
- Reservoir Height - 291 ft.
- Tower Height - 200 ft.
- U/S Tunnel - 18’ dia., 1000’ long
- D/S Tunnel - 18’ X 18.5’, 600’ long
- Gate Chamber - 50’ dia.
- Air Shaft - 11’ dia., 320’ vertical, max. v=140 fps
- 2 RO Gates - 5’ wide X 8.5’ high
- 1 Low Flow Gate – 2’ wide X 3.5’ high
- Max. Q=8,000 cfs, max. v=115 fps @ RO gates

Downstream Tunnel Plan



Downstream Tunnel
Section 1 and Section 2





Instrumentation

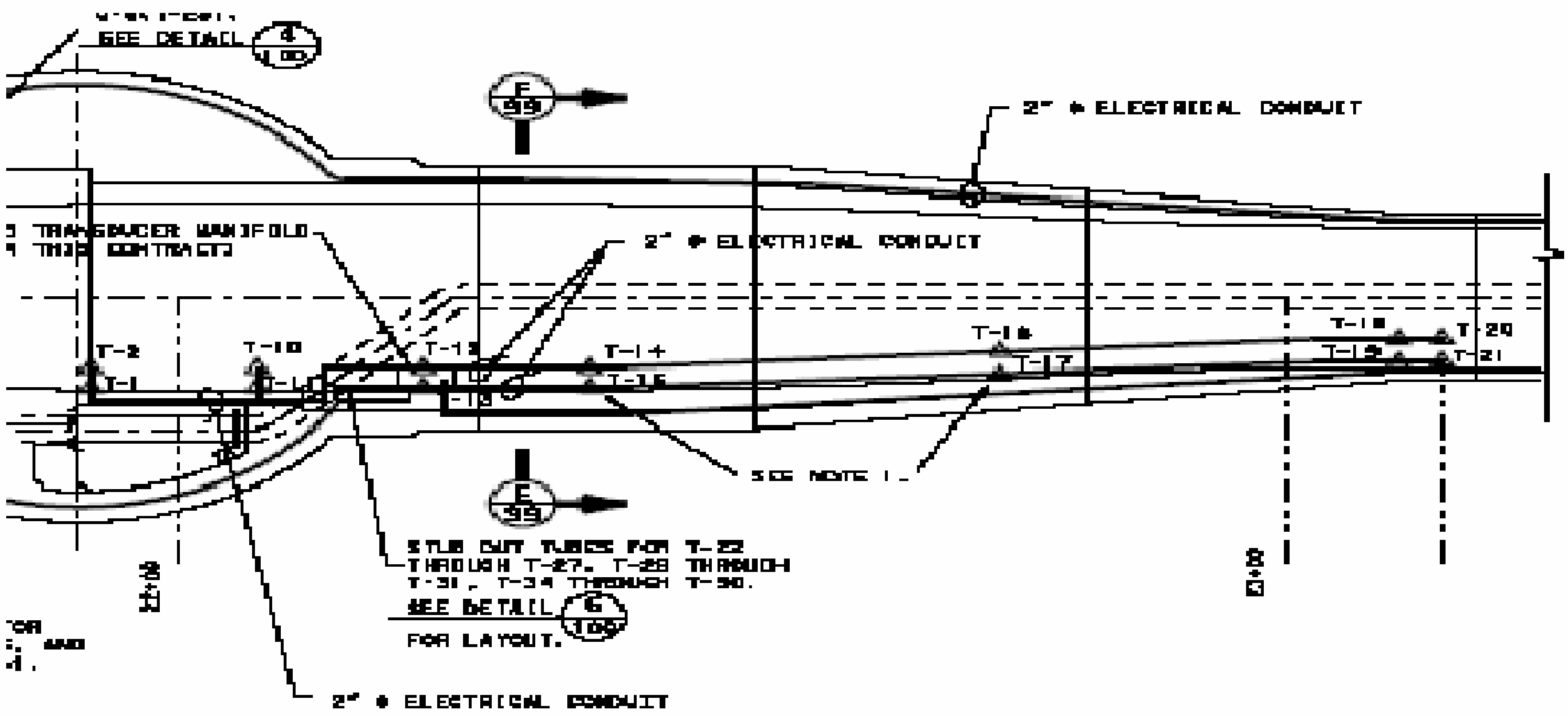


Figure 3 Plan View of Instrumentation (Flush Mounted Pressure Transducers)

Design Assumptions

- Resist external rock and groundwater
- Invert designed as full-depth beam
- High strength silica fume topping for erosion resistance of high velocity flow
- Silica fume bond to base concrete and act monolithically
- No epoxy bonding agent
- No reinforcement across transverse joints

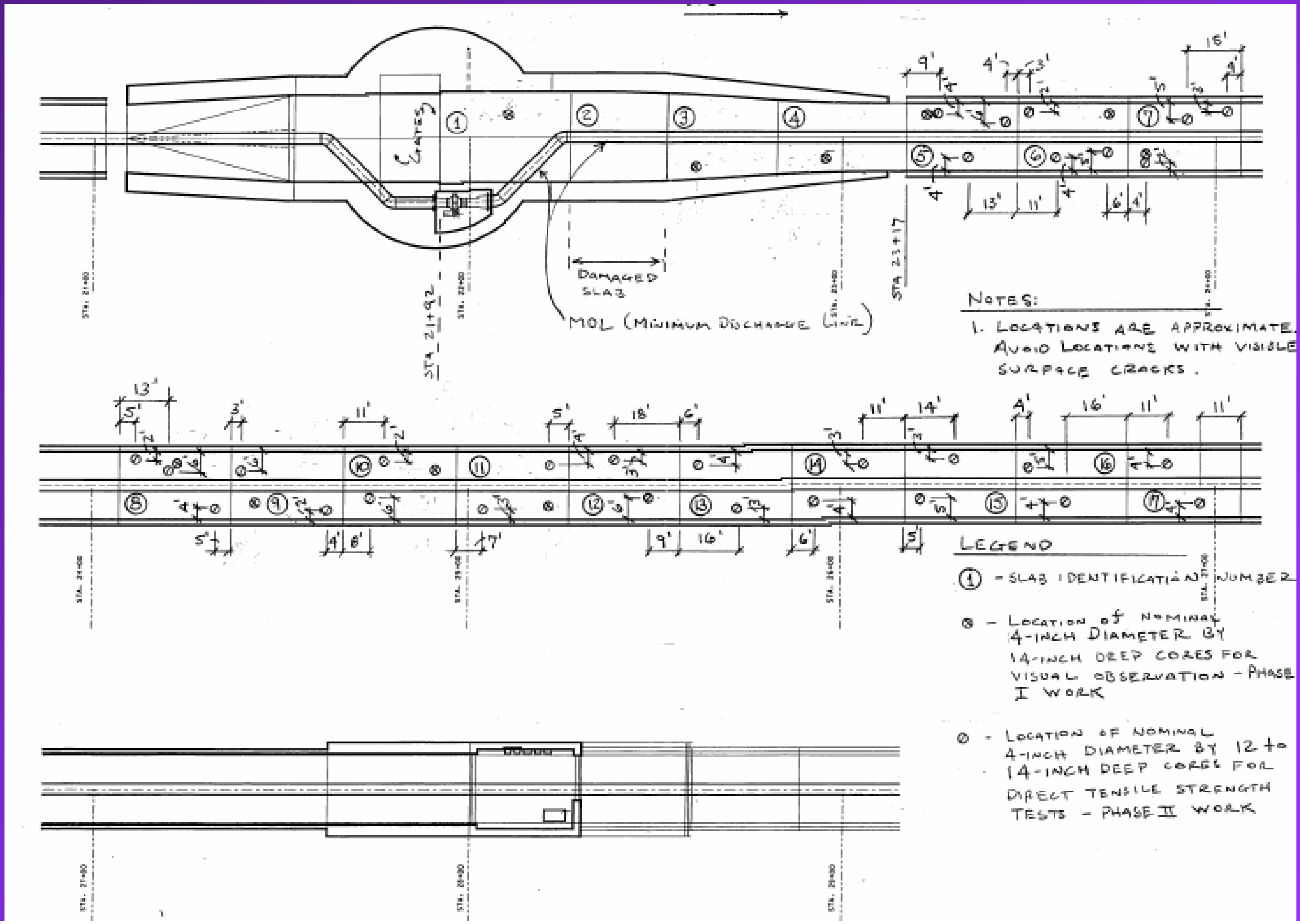
SEVEN OAKS DAM
Investigation and Repair

- Phase 1- Concrete Cores for Visual, Petrography, and Strength Tests
- Phase 2 – Additional Concrete Cores for Visual, Detail Petrography, and Tensile Tests
- Phase 3 – Demolition of Critical Slabs
- Phase 4 - Repair of Critical Slabs
- Phase 5 – Repair of Additional Slabs

Concrete Coring Investigation

(Apr & May05)

67% Cores Debonded



Slab 1 Damage Surface

Fig. 3a – Cracking, delamination, and erosion of Slab 1 surface

Slab 2 Concrete Cores

Fig. 6 – Top surfaces (SFC-CC interface) of Slab 2 cores

Slabs 1 to 17 Typical Concrete Cores

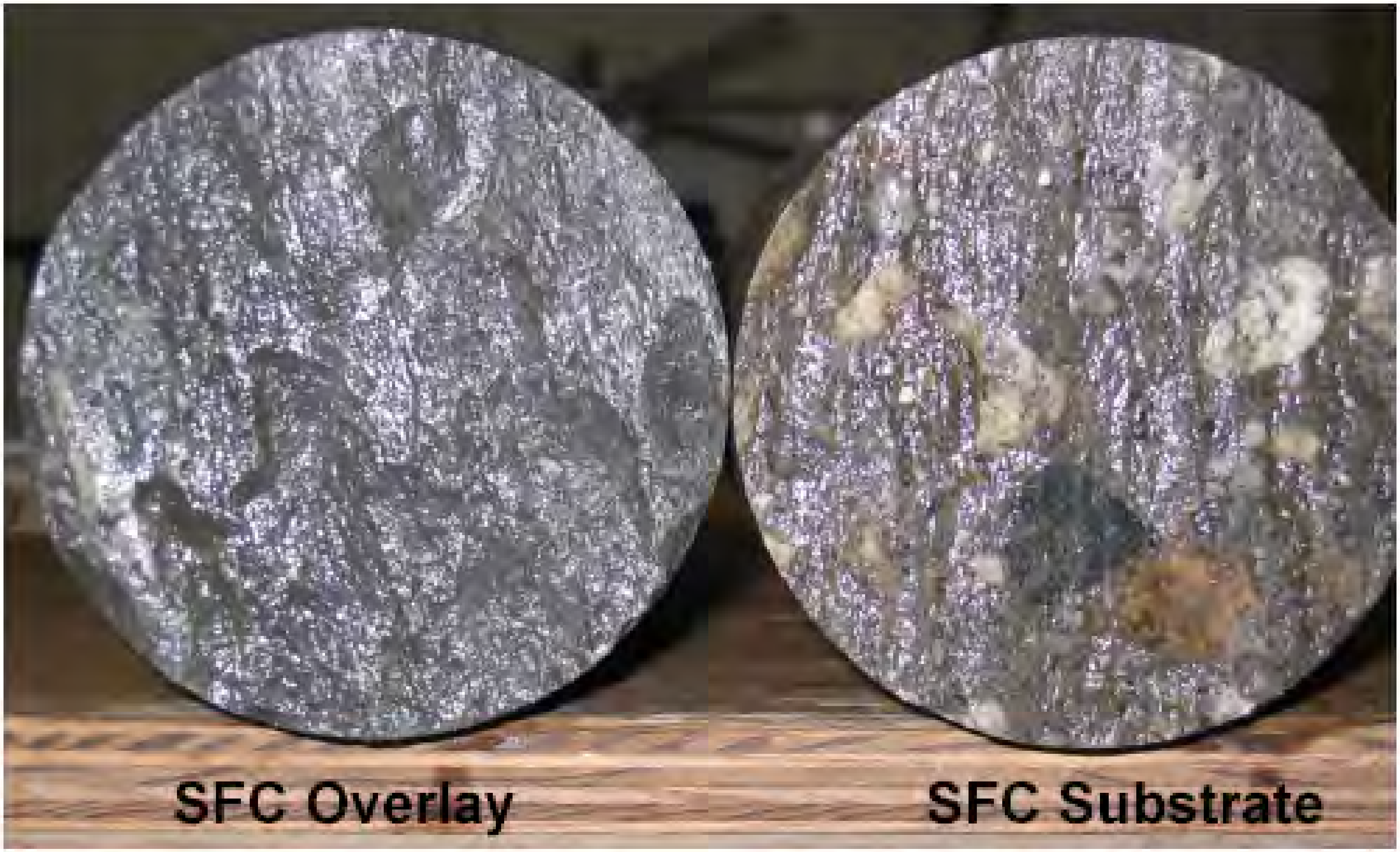


Fig. 9 – Typical failure surfaces on cores from Slabs 7-17

Concrete Cores Investigation

- Phase 1- Concrete Core Testing

  > Completed – 27 Apr 05

  > 67 % cores debonded

  > Compressive strength tests pending

  > Cursury petrography suggests tensile failure from incomplete bond development due to improper surface preparation or cold joint formation;

  > Veneer of carbonate deposit

Concrete Cores Investigation

- Phase 2 – Additional Concrete Core Testing

  > Completed – 4 May 05

  > 63 % cores debonded

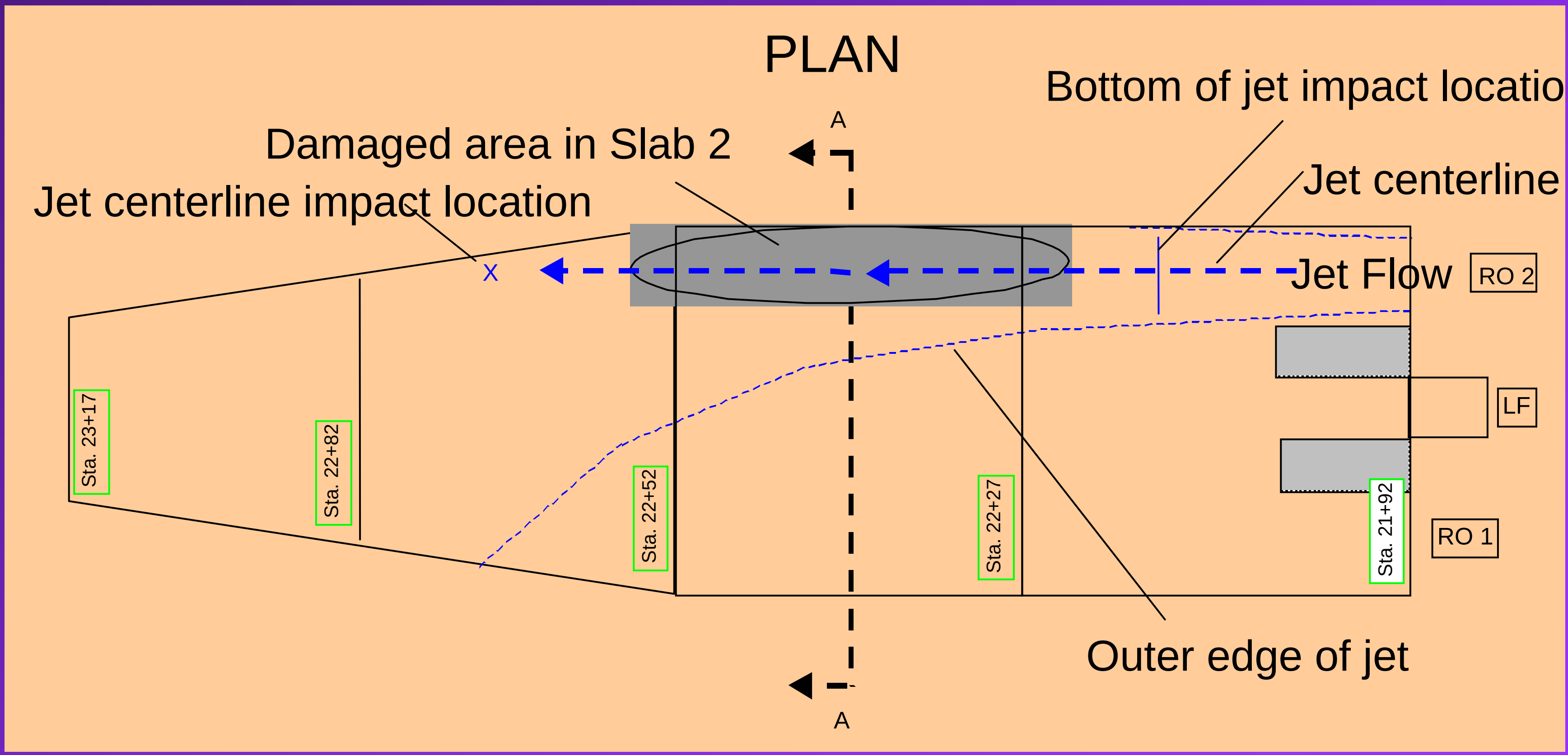
  > Prelim detailed petrography confirms SC/CC interface exhibits layer of solidified carbonate-based residue;

  >Inadequate surface roughness for mechanical bonding; weak concrete at interface due higher W/C;
  >Final report pending

Analysis

- Reservoir at el.2392
- Gate opening at 5.0 ft
- Flow rate 2,520 cfs
- Velocity 130 ft/s
- Stagnation pressure 120 psi, but jet impingement pressure estimated 5 to 10 psi
- Pressure highest at invert joint with wall
- Only 0.7 psi to uplift silica fume layer

Plan View of Damaged Slab Area



Free-Body Diagram of Damaged Slab Cross-section

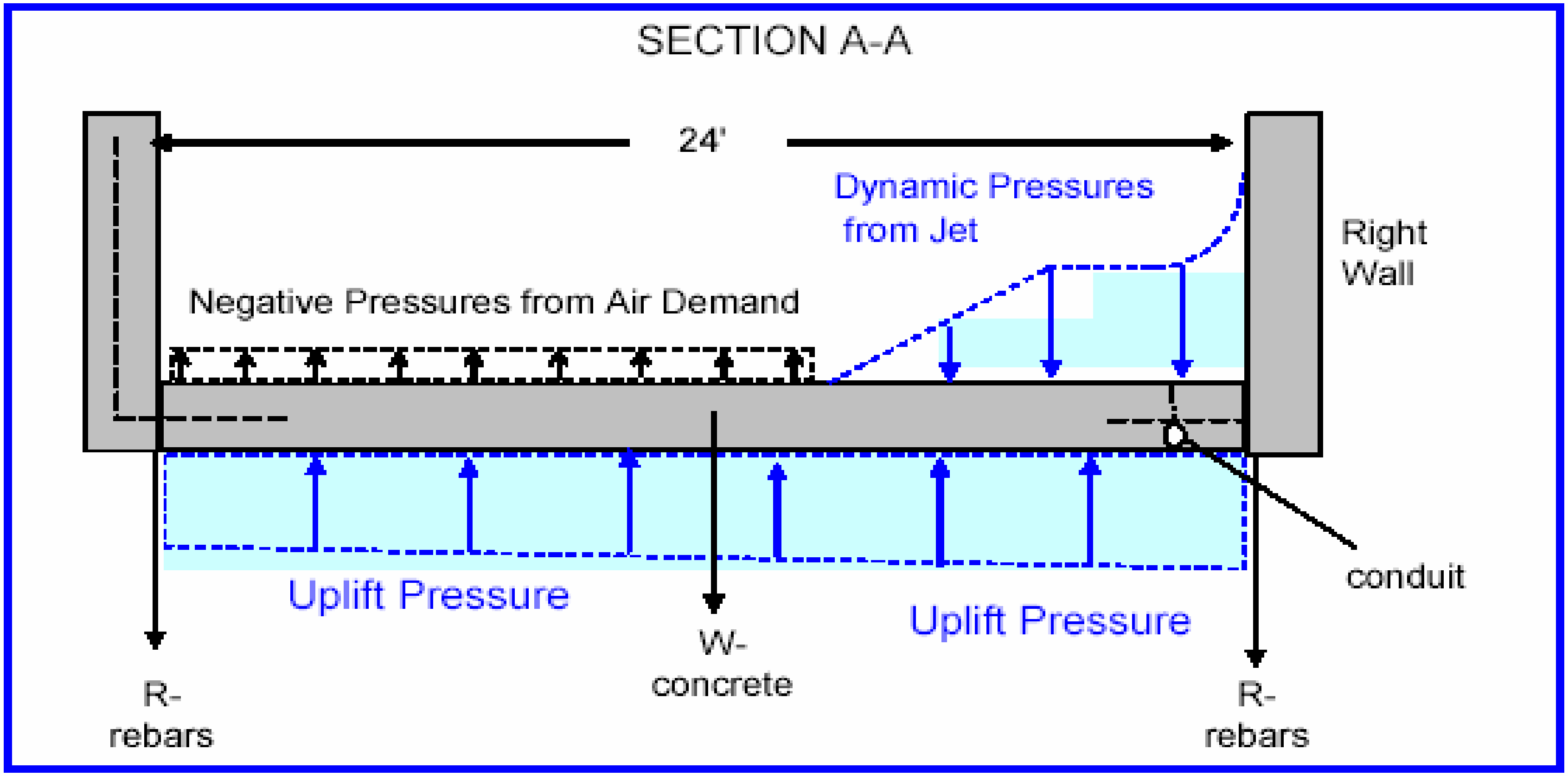


Figure 24 Tunnel Floor Free Body Diagram

Flow Jet Trajectory

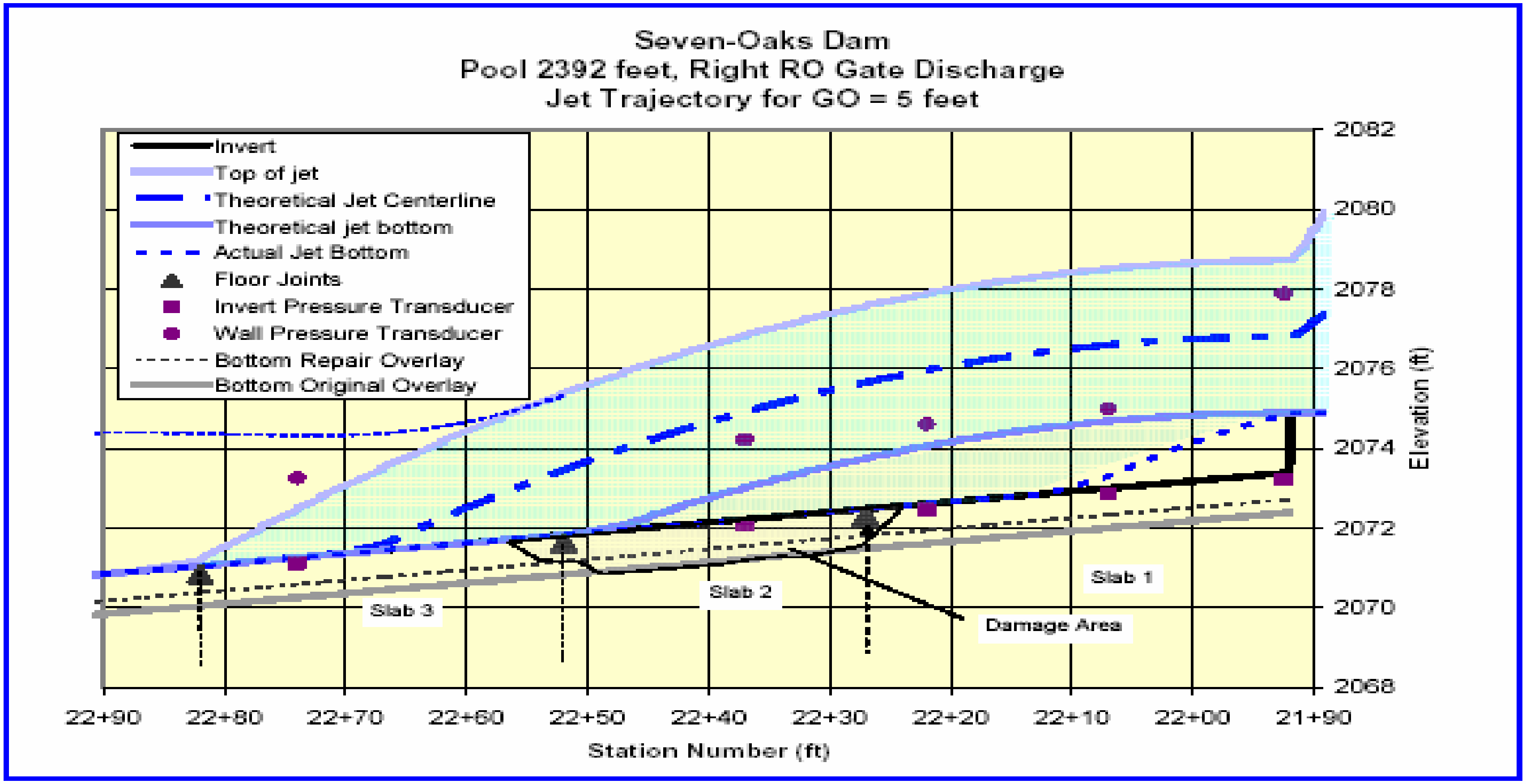


Figure 23 Schematic of Jet Trajectory at Gate Opening 5 feet, Prior to Failure Event

SEVEN OAKS DAM
Tunnel Invert Damage - Cause

- Water Pressure from high velocity flow jet penetrates construction joints.

Tunnel Invert Damage - Cause

- Pressure migrates through seams between poorly bonded to debonded silica fume concrete overlay and substrate concrete and increases.

Tunnel Invert Damage - Cause

- Water pressure under overlay combined with reduced air pressure breaks bond between overlay and substrate concrete, and lifts up overlay.

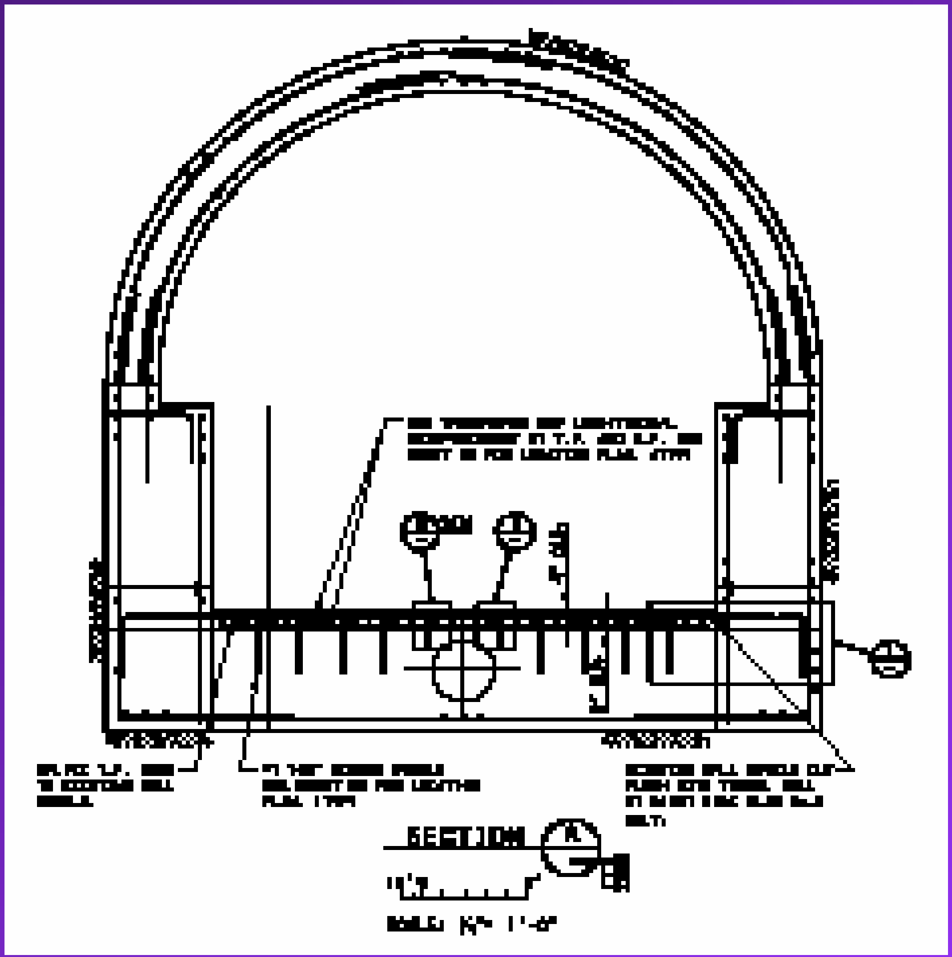
Tunnel Invert Damage - Cause

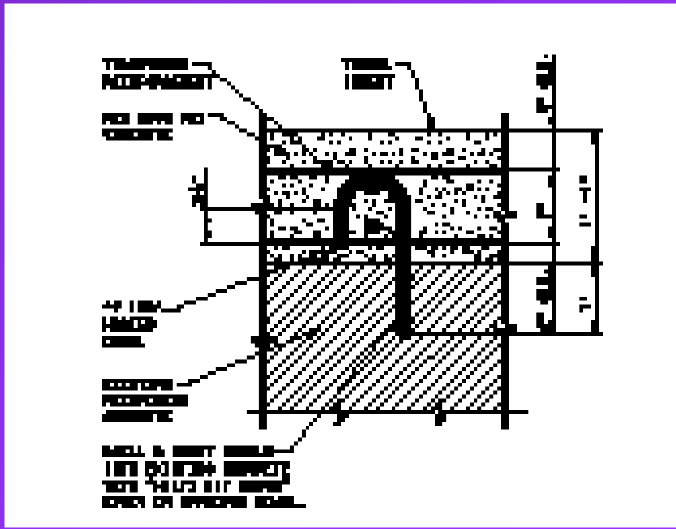
- Impact from jet breaks up overlay slab, pulverizes slab into smaller pieces, and completely erodes away edge of overlay.

SEVEN OAKS DAM
Tunnel Invert Repair Plan

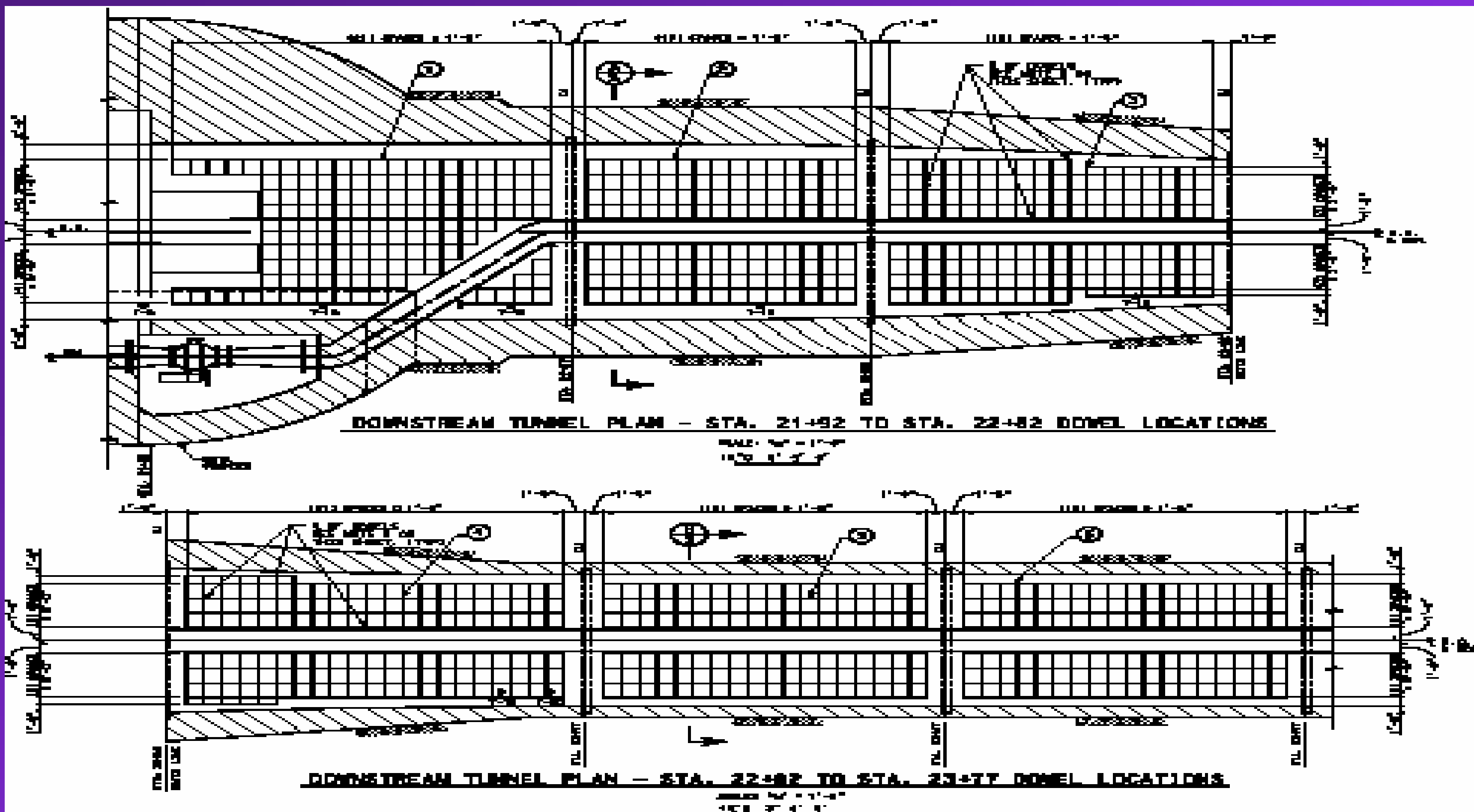
- Remove Damaged and Suspect Slabs
- Anchor New Overlay to Base Concrete
- Assure Proper Joint Preparation & Bond Enhancement
- Use Non-Shrink High Strength Concrete

Slab Repair Plan





Slab Repair Plan



SEVEN OAKS DAM
Repair Schedule

- Phase 3 – Demolition Critical Slabs 1 to 6

  Construction Complete – 5 Aug 2005

- Phase 4 – Repair Critical Slabs 1 to 6

  Construction Complete – 30 Sep 2005

- Phase 5 – Demolition and Repair Additional Slabs as Required

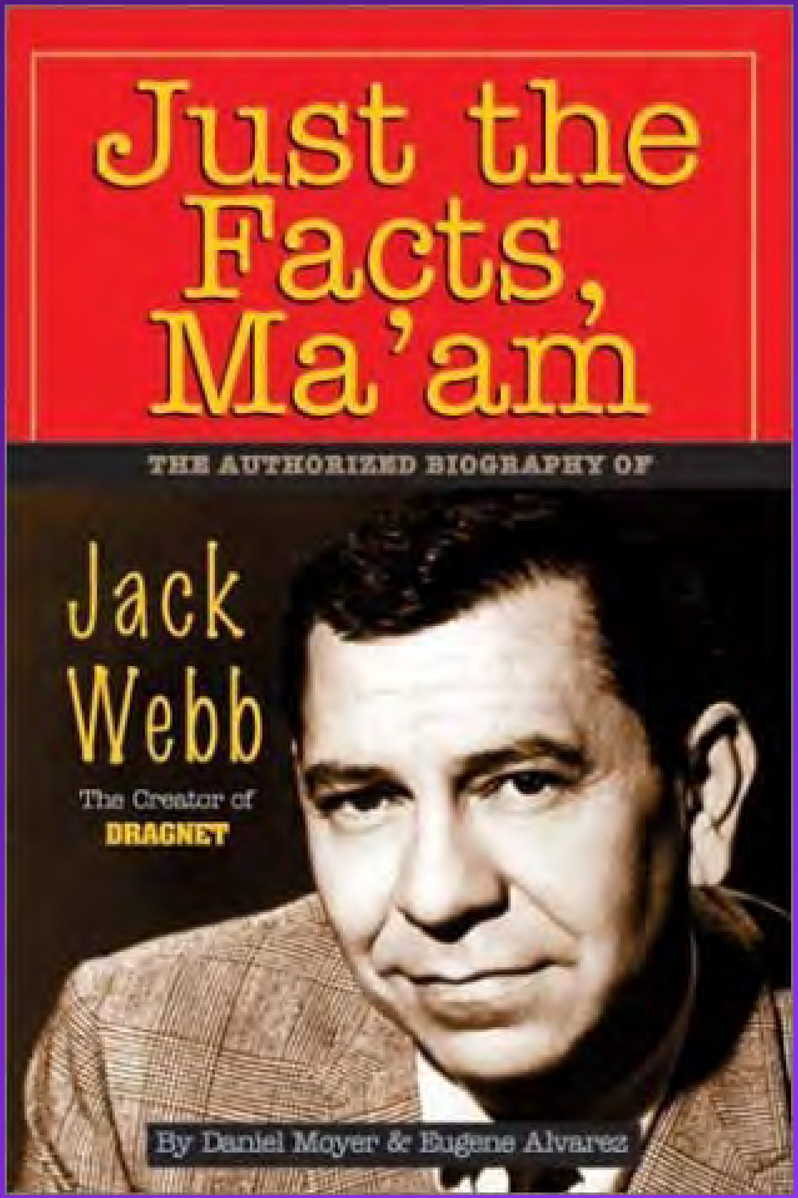
  Construction Complete – 30 Sep 2006

“Dum Dee Dum Dum
Dum Dee Dum Dum Dum”

Music Theme

“Dragnet” Detective Drama Series

1952-59,1967-70



1920 - 1982

Creator and

Main Character of

"Dragnet"

TV Series

Picture Courtesy of:
http://www.amazon.com/exec/obidos/ASIN/092976529X/thefiftieswebsit/

TRUST

SPL

QUALITY TEAMWORK

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Huntington District

Bluestone Dam DSA Anchor Challenges

Tri-Service Infrastructure Systems Conference

Michael McCray, P.G.
(304) 399-5234

Topics

- **Brief Overview of Bluestone Dam**
- **DSA efforts completed to date / ongoing and future efforts**
- **Lessons learned from the field anchor study**

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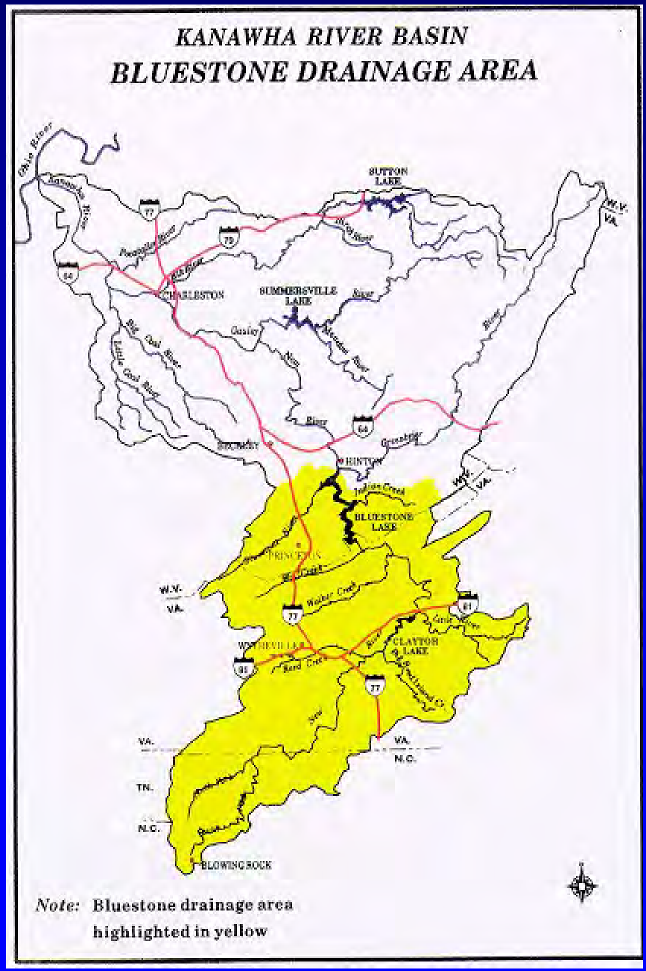
Location



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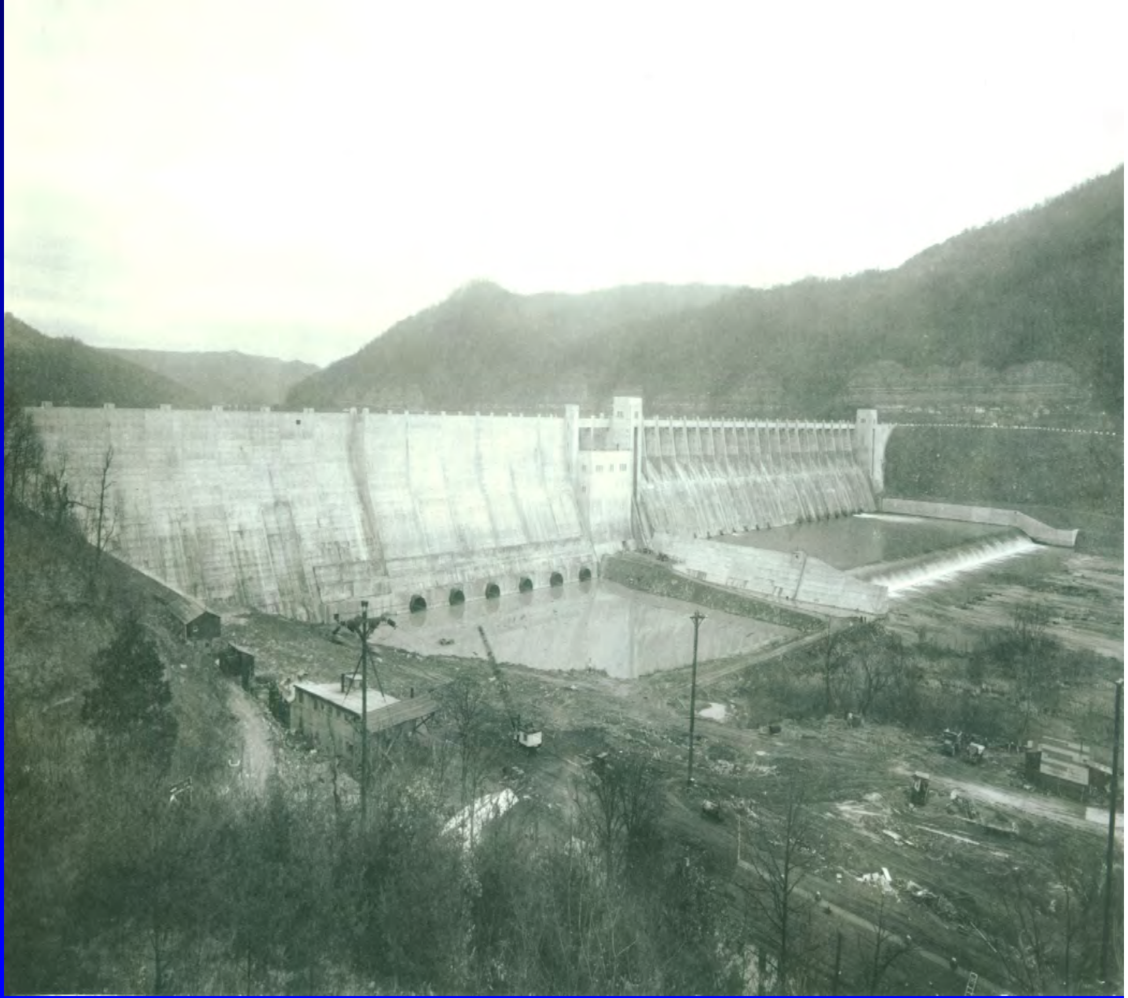
Features

- **Concrete gravity dam**
  - **165' high**
  - **2060' long**
- **4600 mi² drainage area**
- **Outlet works**
  - **16 sluices**
  - **Gated spillway (21)**
- **6 penstocks**



Construction

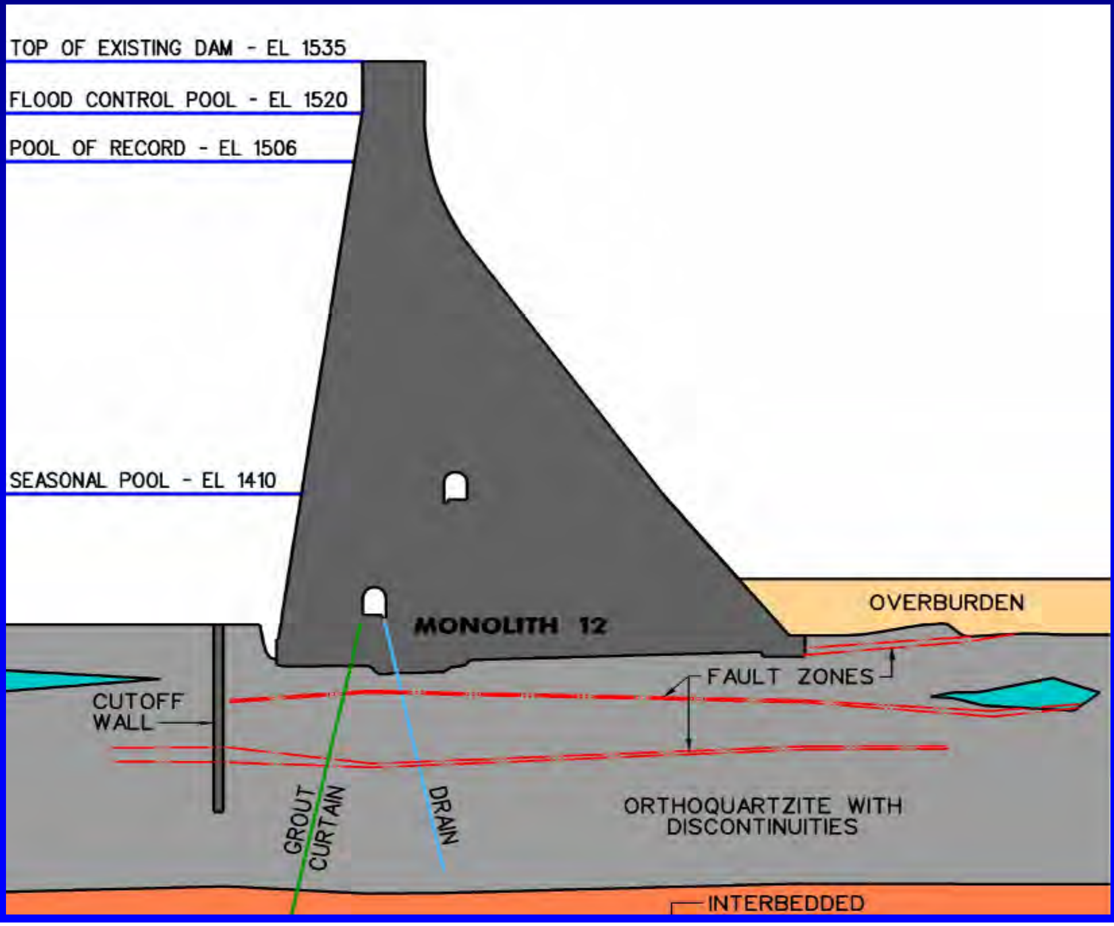
- Started in 1942
- Suspended in 1944 (WWII)
- Resumed in 1946
- Completed in 1948
- Hydropower not implemented
  - Storage re-allocated for flood control
  - Pool elevation reduced from 1490 feet to 1410 feet

Bluestone Dam Overview

Spillway 790' long

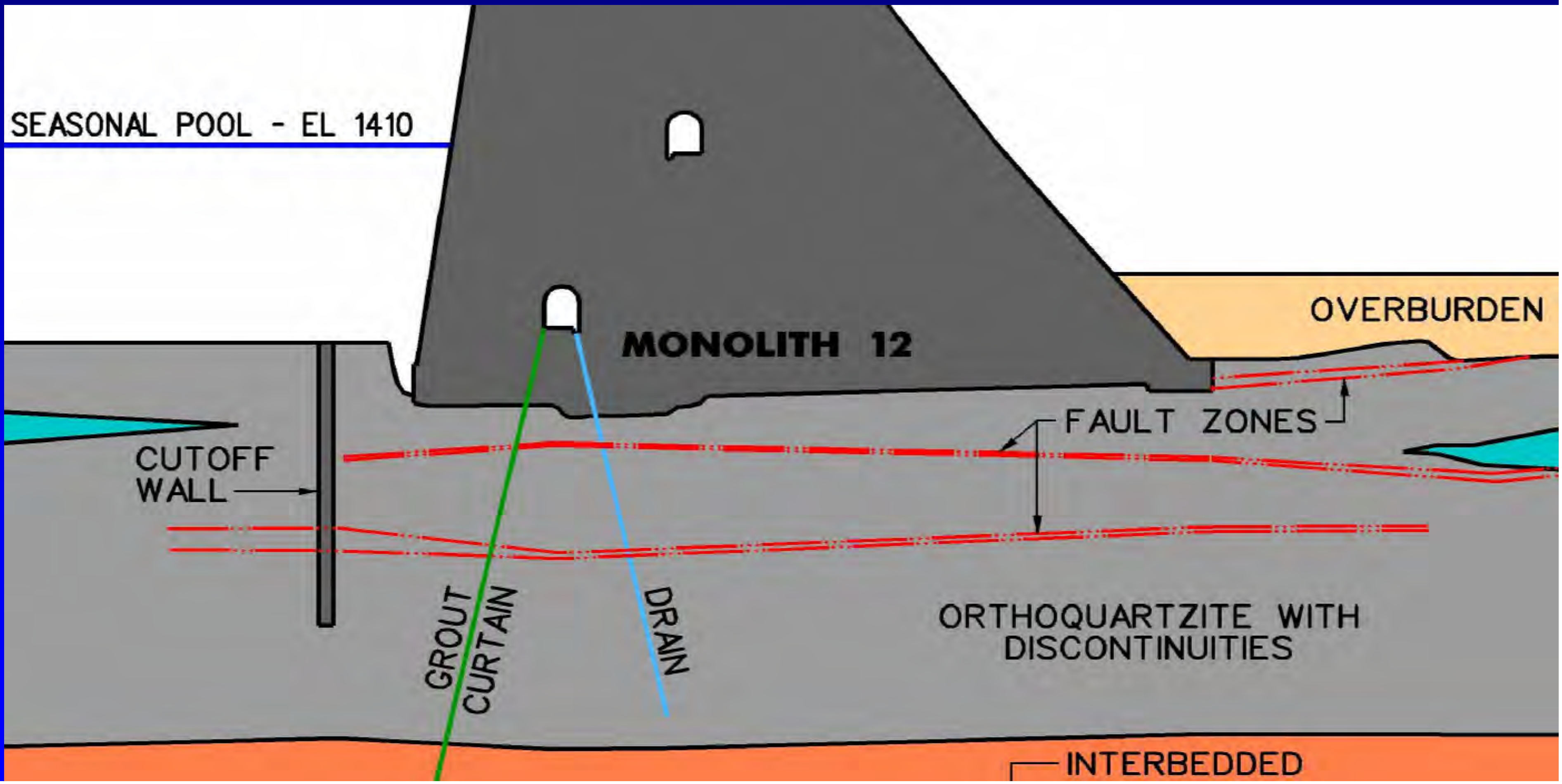
Bluestone Dam Overview

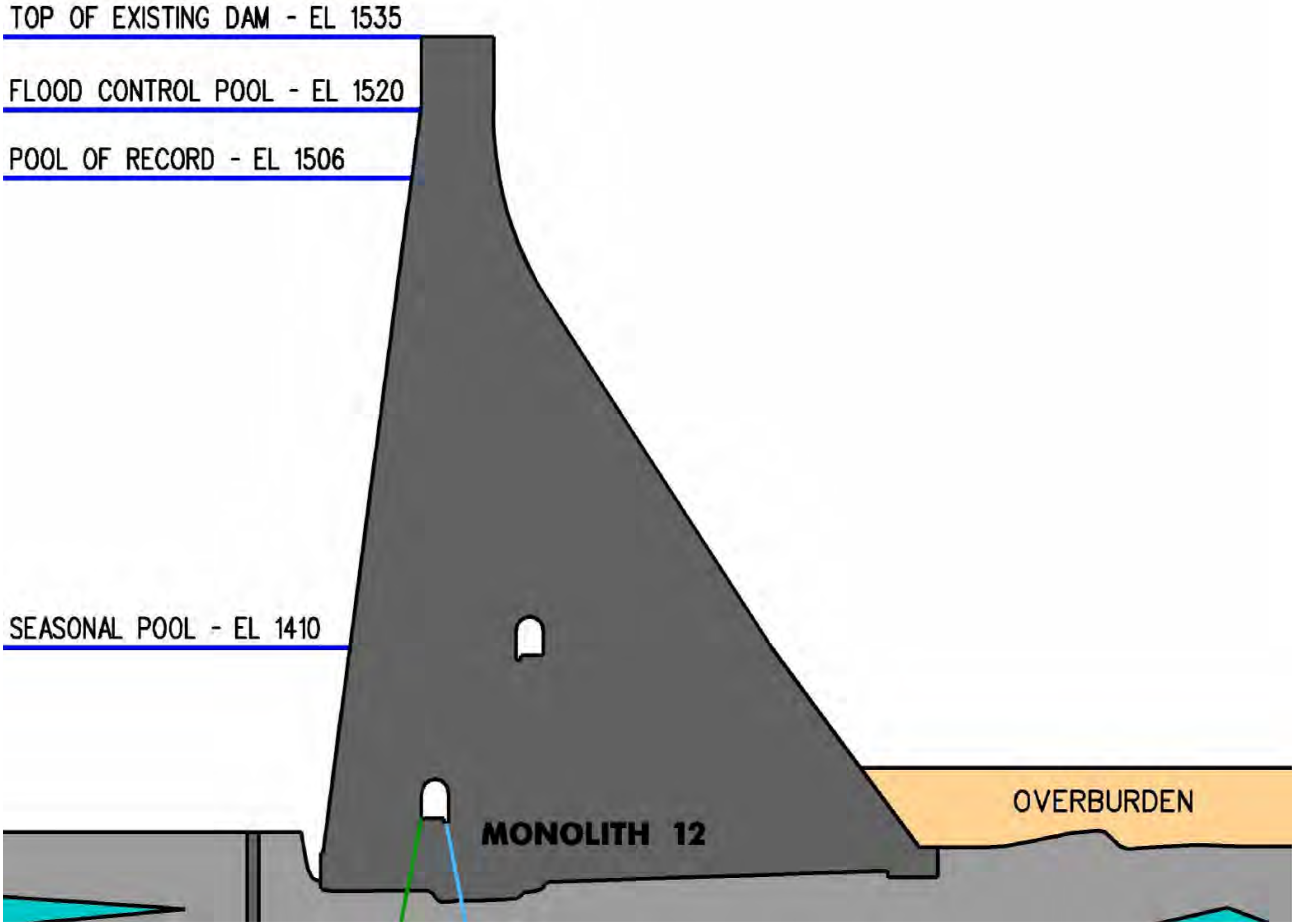
- **Project foundation:**
  - **Valley floor:**
    - **Founded on orthoquartzite or interbedded orthoquartzite and carbonaceous shale**
  - **Abutments:**
    - **Shales**
    - **Siltstone**
    - **Sandstone**

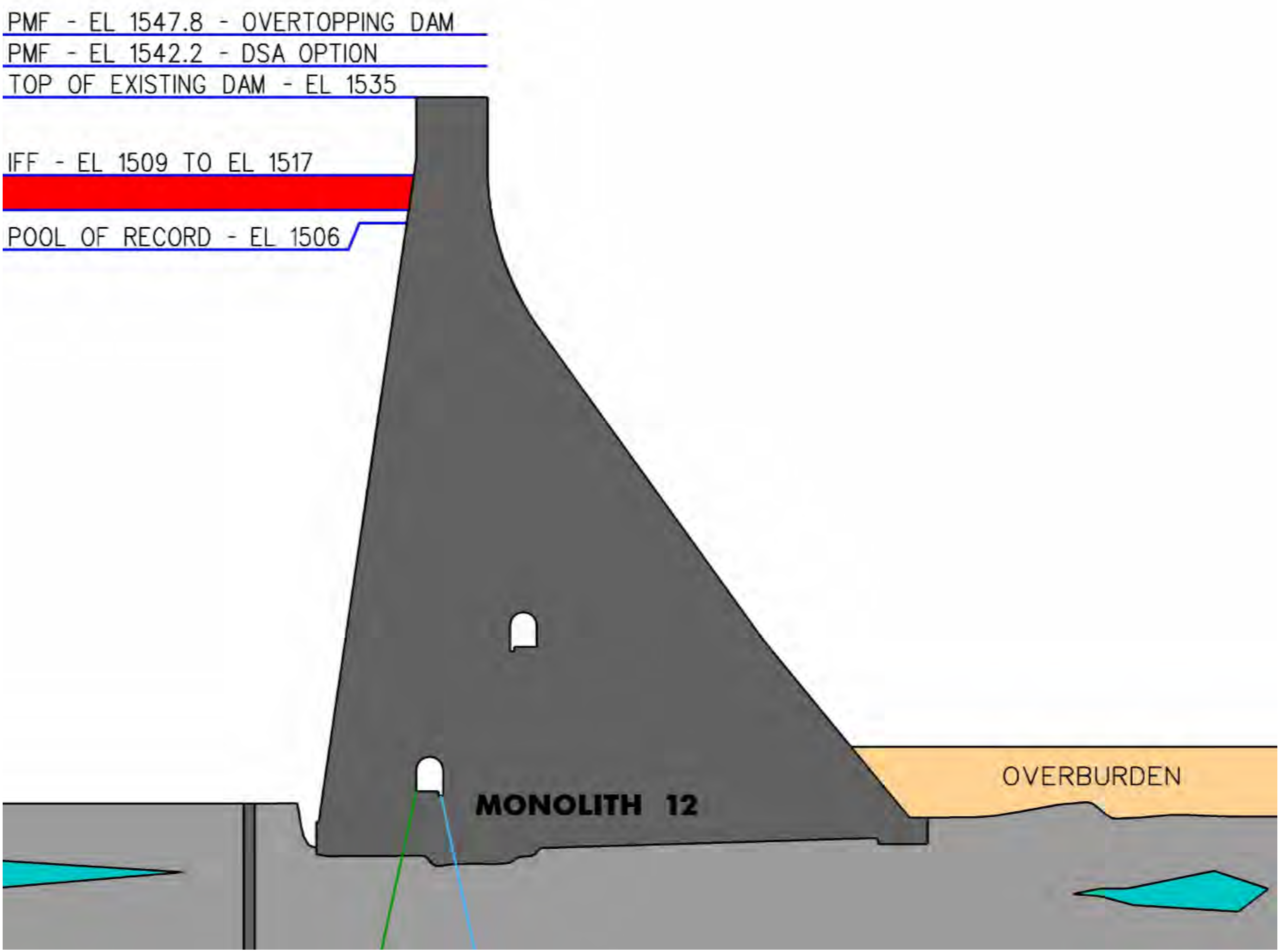


DSA Project History

Fault was not removed from monoliths 10 through 12




TOP OF EXISTING DAM - EL 1535
FLOOD CONTROL POOL - EL 1520
POOL OF RECORD - EL 1506
SEASONAL POOL - EL 1410
OVERBURDEN
MONOLITH 12


PMF - EL 1547.8 - OVERTOPPING DAM
PMF - EL 1542.2 - DSA OPTION
TOP OF EXISTING DAM - EL 1535
IFF - EL 1509 TO EL 1517
POOL OF RECORD - EL 1506
MONOLITH 12
OVERBURDEN

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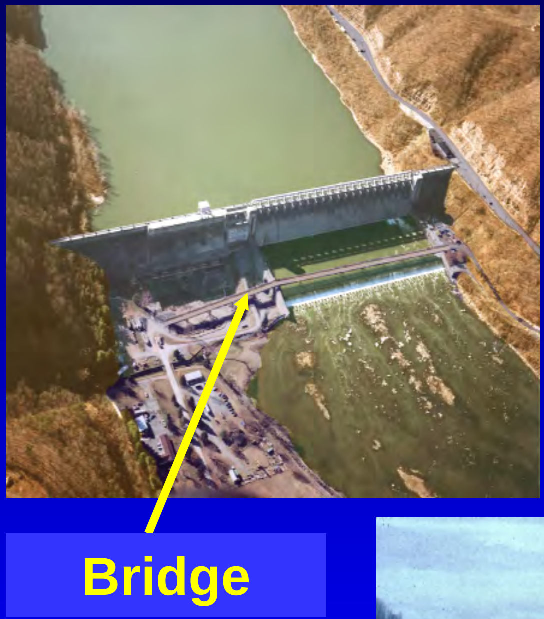
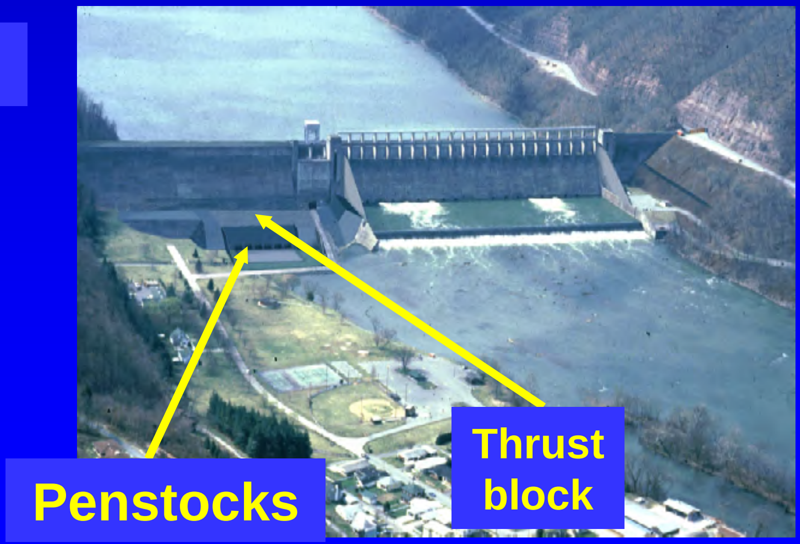
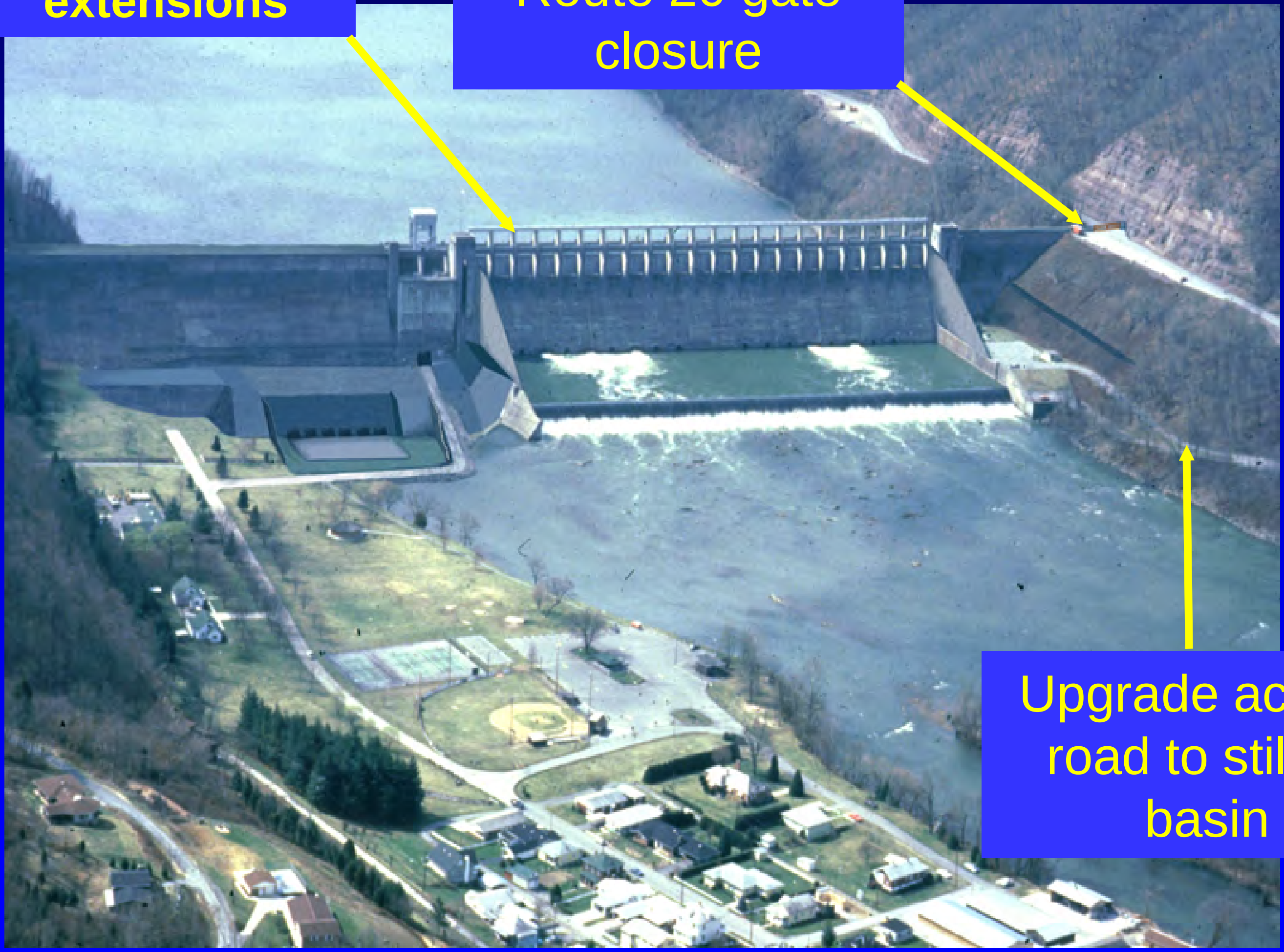
Bluestone DSA Phase 1

- **Phase I Contract**
  - **Awarded Sept. 2000**
  - **Completed 2004**
- **Project Features**
  - **2 Lane Bridge**
  - **Thrust Blocks**
  - **Extending Penstocks**
  - **Sacrificial Bulkheads**





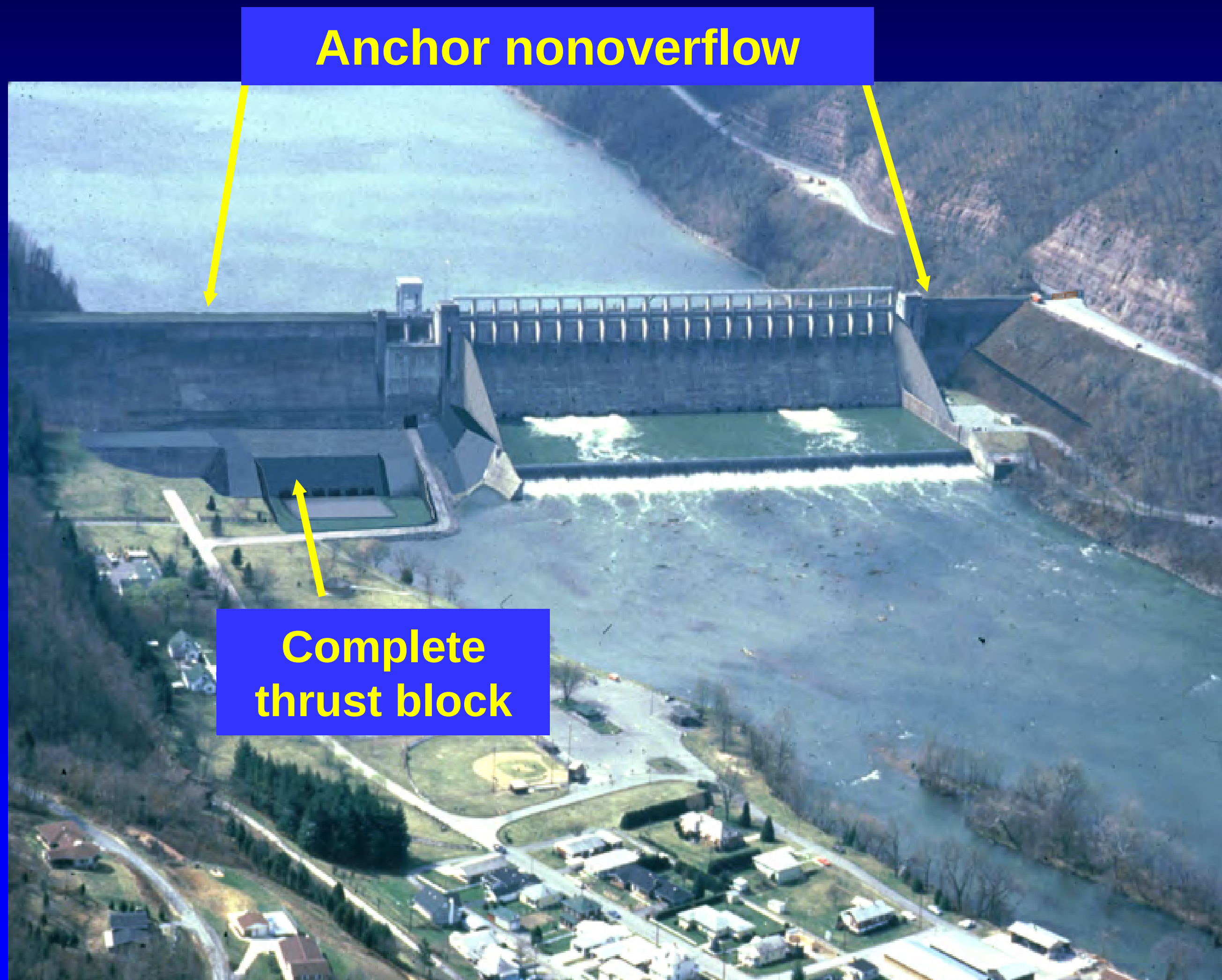
Bluestone DSA – Phase 2A



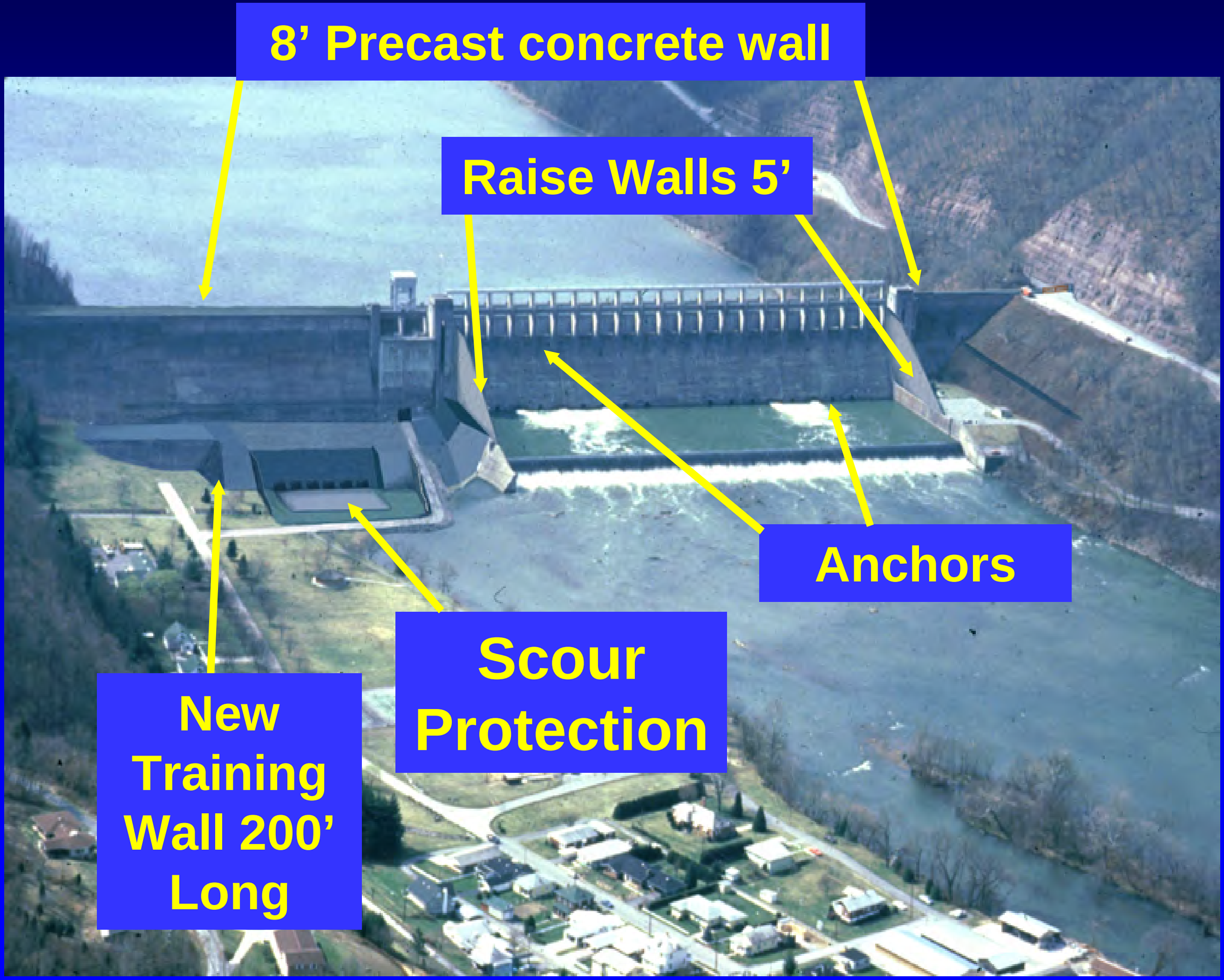
Bluestone DSA – Phase 2B

- Awarded 31 May 2005
- Brayman Construction Corporation
- $30,000,000

Bluestone DSA – Phase 2B



Bluestone DSA – Phase 2C



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Lessons Learned from the Field Anchor Study

- **Corrosion Protection**
- **Drill Hole Alignment**

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2002 Field Anchor Study

- **Install Four 61 Strand Production Anchors**
  - **Two from top of dam and instrumented (8º)**
  - **Two from face of dam (45º)**
  - **Corrosion protection is 10" corrugated polyethylene pipe 70-mil.**
  - **Bond zones forty feet.**
  - **Stressed lengths 130 to 200 feet.**

Field Anchor Study (cont.)

- **Install Eight Bond Stress Test Anchors**
  - **18 strand anchors in 5" holes**
  - **Bond zones 10'**
  - **Load to, or near, bond failure**
  - **4 lithologies tested**
  - **Parallel lab pull-out tests for comparison**

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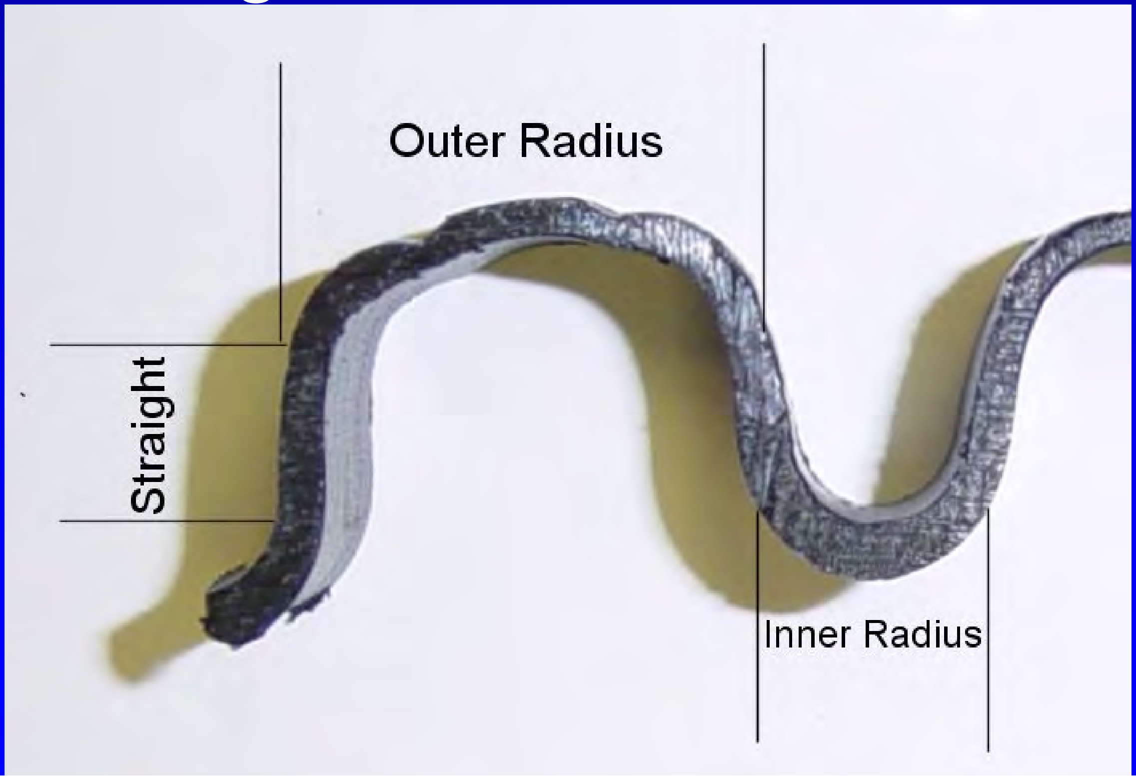
Lessons Learned from the Field Anchor Study

- **Corrosion Protection**
  - **Corrugated**
    - **Thickness**
    - **Handling**
  - **Sheathing**
    - **Polyethylene VS Polypropylene**
    - **Handling**

Corrosion Protection

- **Corrugated (Prinsco, Goldline)**
  - **70-mil (measured at the crown)**
    - **84-mil max**
    - **56-mil minimum**
  - **550 ft lengths**



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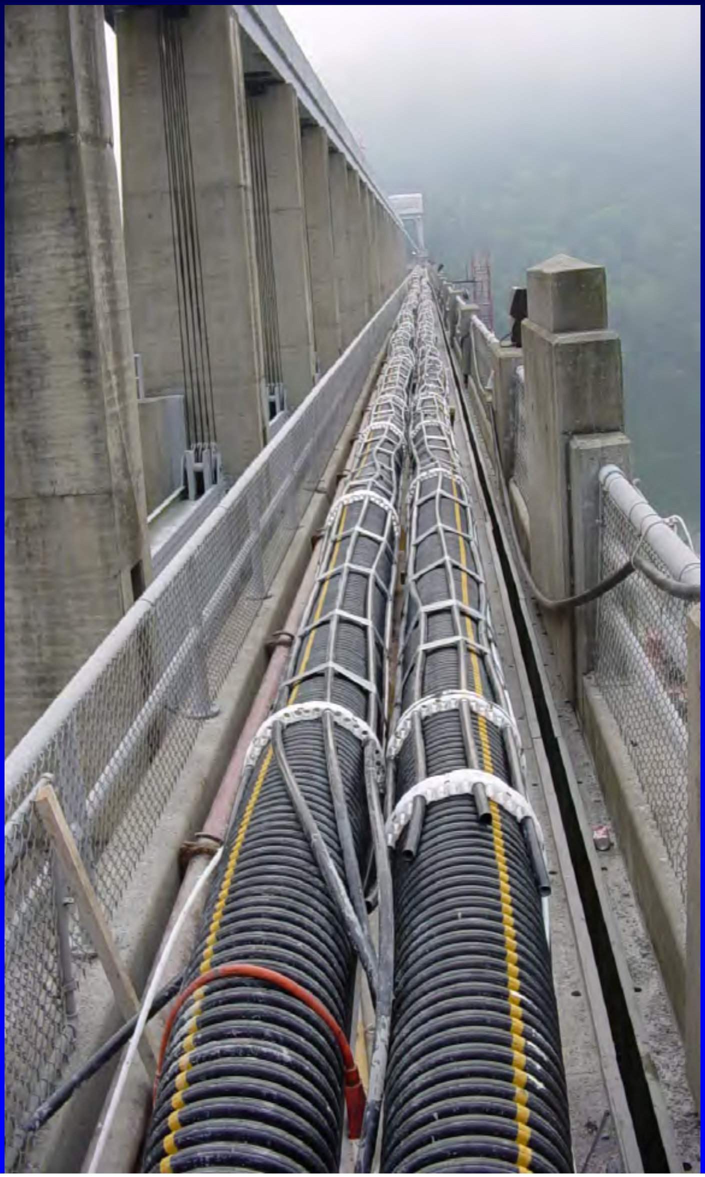
Corrosion Protection

Corrugated collapses

- First lift 9 ft
- Second lift 30 ft
  - Collapses at 9 ft and travels up 8 ft
- All lifts reduced to 20 ft



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Smooth Walled HDPE ½” Thick

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HDPE Welded

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of Engineers
Huntington District

Corrosion Protection

Corrosion Protection

- **Corrugated** **(Prinsco, Goldline)**
  - **4-mm (157-mil)**
    - **Manufactured in maximum 60 ft sections**
- **Smooth Wall** **(CPChem, Driscoplex 4100**
  - **0.5 inch**

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Corrosion Protection

- **Smooth Wall Collapse**
  - **First lift 10 ft**
  - **Second lift 41ft**
  - **Third lift 119 ft (to the surface)**
    - **Collapse at 51.5 ft**

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Corrosion Protection

- **Critical buckling pressure for 10” diameter, 70-mil corrugated: 19 PSI**
- **Critical buckling pressure for 10” diameter, 157-mil corrugated: 59 PSI**
- **Critical buckling pressure for 10” diameter, 0.50-inch smooth: 19 PSI**

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Corrosion Protection

Specifications call for a 100-mil corrugated

- **Critical buckling pressure for 10” diameter, 100-mil corrugated: 39 PSI**

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Installation of Corrugated

Installation of Corrugated

Specifications call for a simple falling head test on the installed, but ungrouted corrugated.

Loss of less than 2.75 gallons in 10 minutes at 5 psi head shall constitute a watertight encapsulation.

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Corrosion Protection

Field Fix of Polyethylene


NICHOLSON
NICHOLSON
9. 24. 20

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Tendon Installation

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Corrosion Protection

Specifications call for a polypropylene hot-melt extruded coating. Polypropylene is much tougher than polyethylene sheathing but does cost more.

Alignment Tolerance Field Anchor Study

The scope specified a minimum drill tolerance of 1 in 150. Each drilled hole was surveyed for positional accuracy by the Baker-Hughes INTEQ using the Seeker™ Surveying System.

Survey accuracy

1 in 700 8-degree holes
1 in 300 45-degree holes

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Starter Guide

Sub-Bearing Plate and Trumpet

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Installation and Alignment

Installation and Alignment

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Installation and Alignment

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15" Hammer

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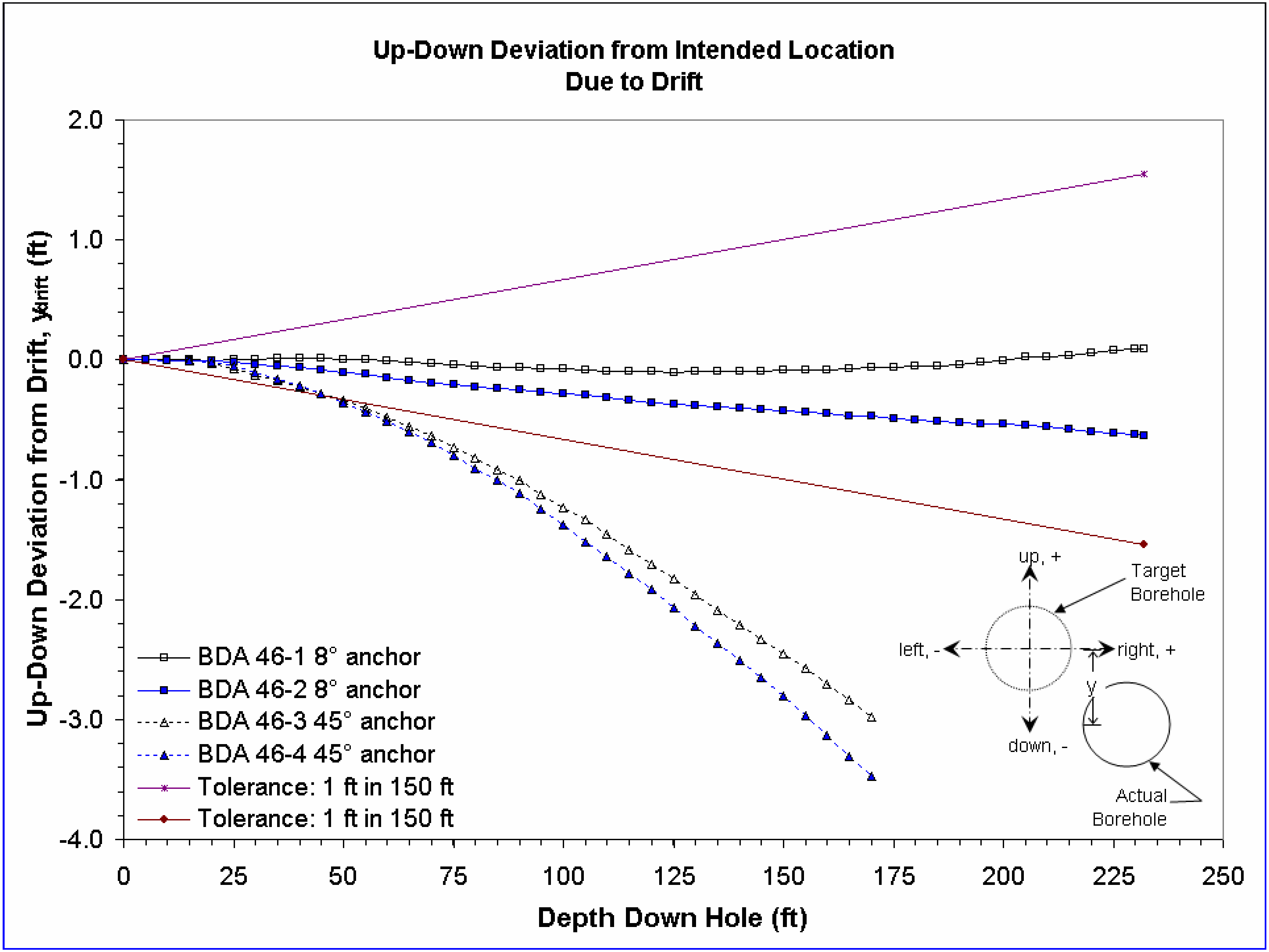
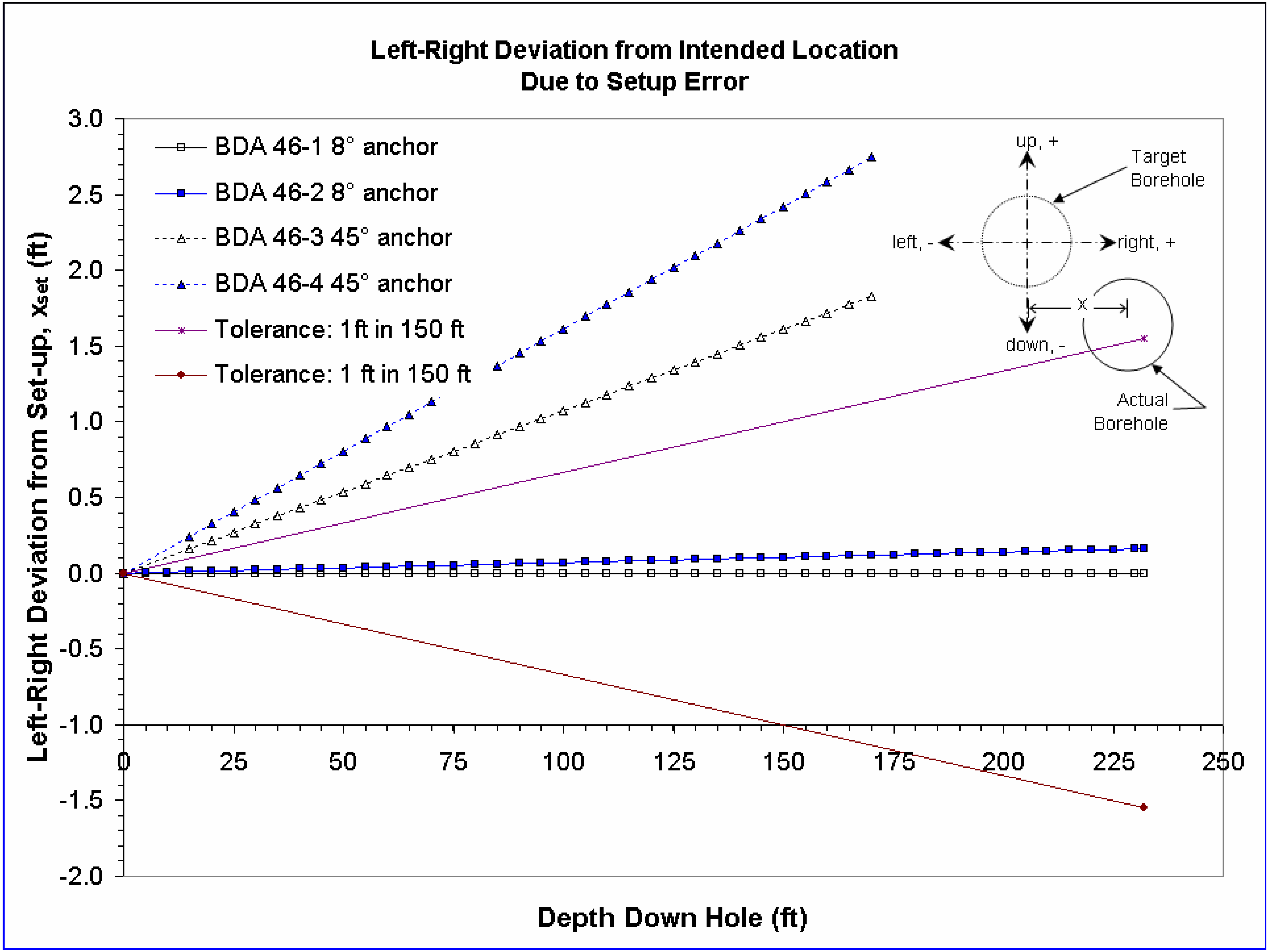
Alignment Tolerances

- **Crest Anchors**
  - **1 in 110 feet**
- **Anchors on downstream slope**
  - **1 in 20 feet**


Up-Down Deviation from Intended Location
Due to Drift
Up-Down Deviation from Drift, ydrift (ft)
2.0
1.0
0.0
-1.0
-2.0
-3.0
-4.0
0
25
50
75
100
125
150
175
200
225
250
Depth Down Hole (ft)
BDA 46-1 8° anchor
BDA 46-2 8° anchor
BDA 46-3 45° anchor
BDA 46-4 45° anchor
Tolerance: 1 ft in 150 ft
Tolerance: 1 ft in 150 ft
up, +
down, -
left, -
right, +
y
Target
Borehole
Actual
Borehole


Left-Right Deviation from Intended Location
Due to Setup Error
Left-Right Deviation from Set-up, x_{set} (ft)
Depth Down Hole (ft)
BDA 46-1 8° anchor
BDA 46-2 8° anchor
BDA 46-3 45° anchor
BDA 46-4 45° anchor
Tolerance: 1ft in 150 ft
Tolerance: 1 ft in 150 ft
up, +
down, -
left, -
right, +
Target Borehole
Actual Borehole
X
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
0
25
50
75
100
125
150
175
200
225
250

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Alignment Tolerances

Each bidder was given a video documenting the lessons learned from the 2002 field anchor study and a copy of a report on directional drilling and bore hole alignment measurement technology.

Alignment Tolerances

Specifications call for each anchor hole to be surveyed using a rate gyrocompass, or equal equipment. If the hole alignment is not within these tolerances, the hole shall be backfilled and redrilled at the contractor's expense.

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Huntington District

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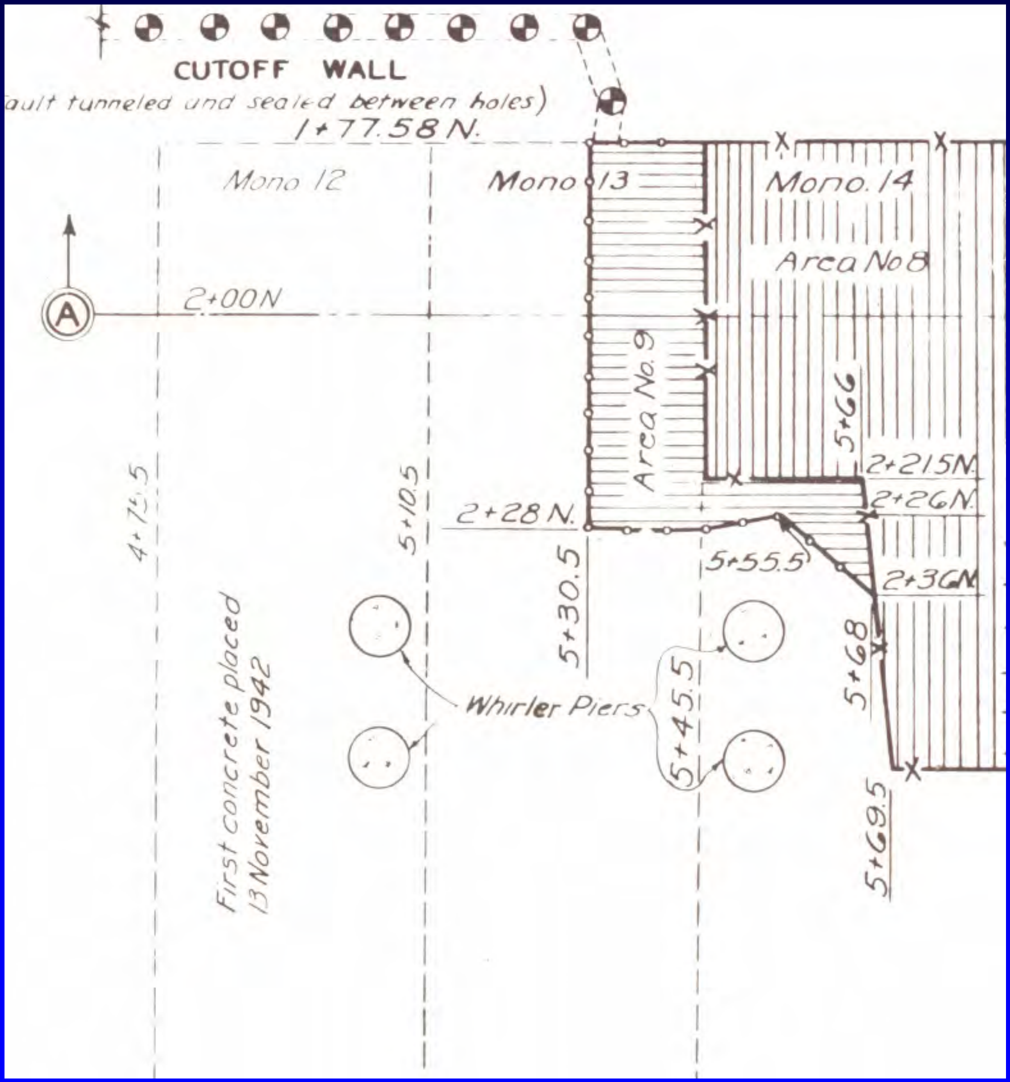
Questions?

Michael McCray
Phone (304) 399-5234
E-mail mikem@mail.orh.usace.army.mil

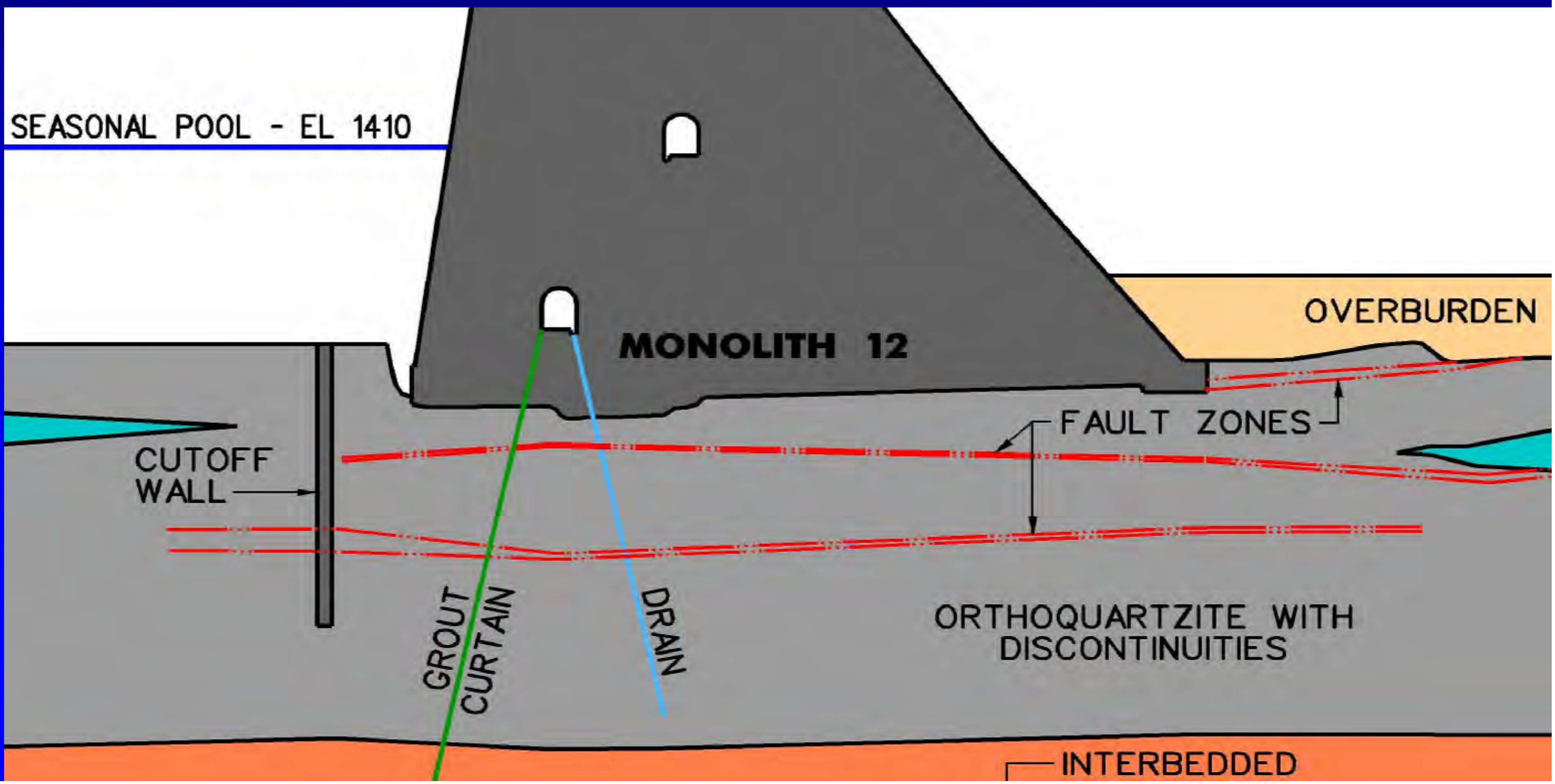
Foundation Conditions

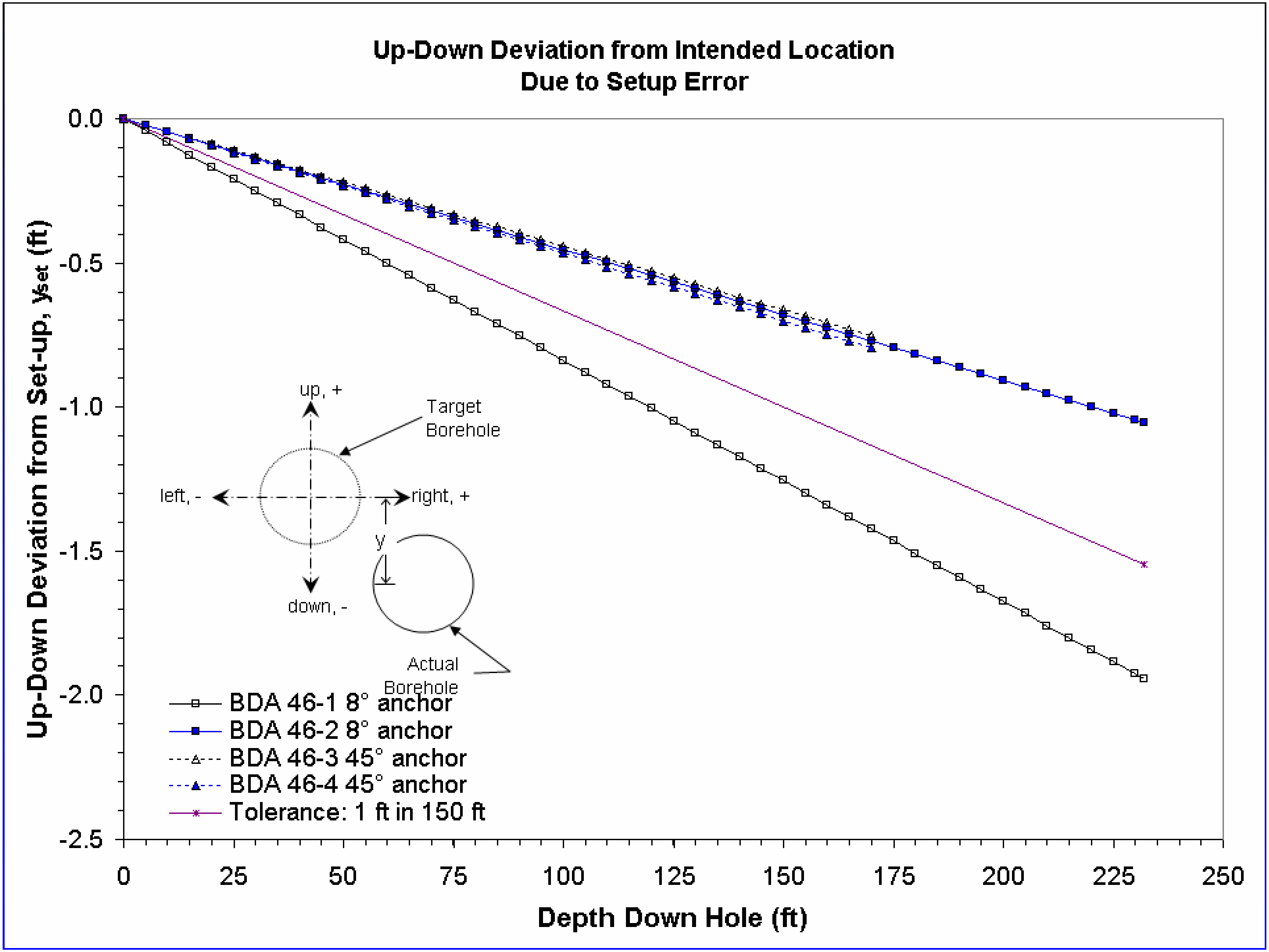
- **Construction Events**
  - **Fault was only partially removed from monoliths 13 and 14**
  - * **Fault was not removed from monoliths 10 through 12**



DSA Project History

Fault was not removed from monoliths 10 through 12





Up-Down Deviation from Intended Location
Due to Setup Error
Up-Down Deviation from Set-up, y_{set} (ft)
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
0
25
50
75
100
125
150
175
200
225
250
Depth Down Hole (ft)
up, +
down, -
left, -
right, +
y
Target Borehole
Actual Borehole
BDA 46-1 8° anchor
BDA 46-2 8° anchor
BDA 46-3 45° anchor
BDA 46-4 45° anchor
Tolerance: 1 ft in 150 ft

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CANTON DAM
SPILLWAY STABILITY

Tulsa District

Is a Test Anchor Program Necessary?

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CANTON DAM
SPILLWAY STABILITY

- **Background and History**
- **Determining Anchor Capacity**
- **Investigation and Test Anchor Program**
- **Summary**

CANTON DAM
SPILLWAY STABILITY

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- **Background and History**

CANTON LAKE LOCATION

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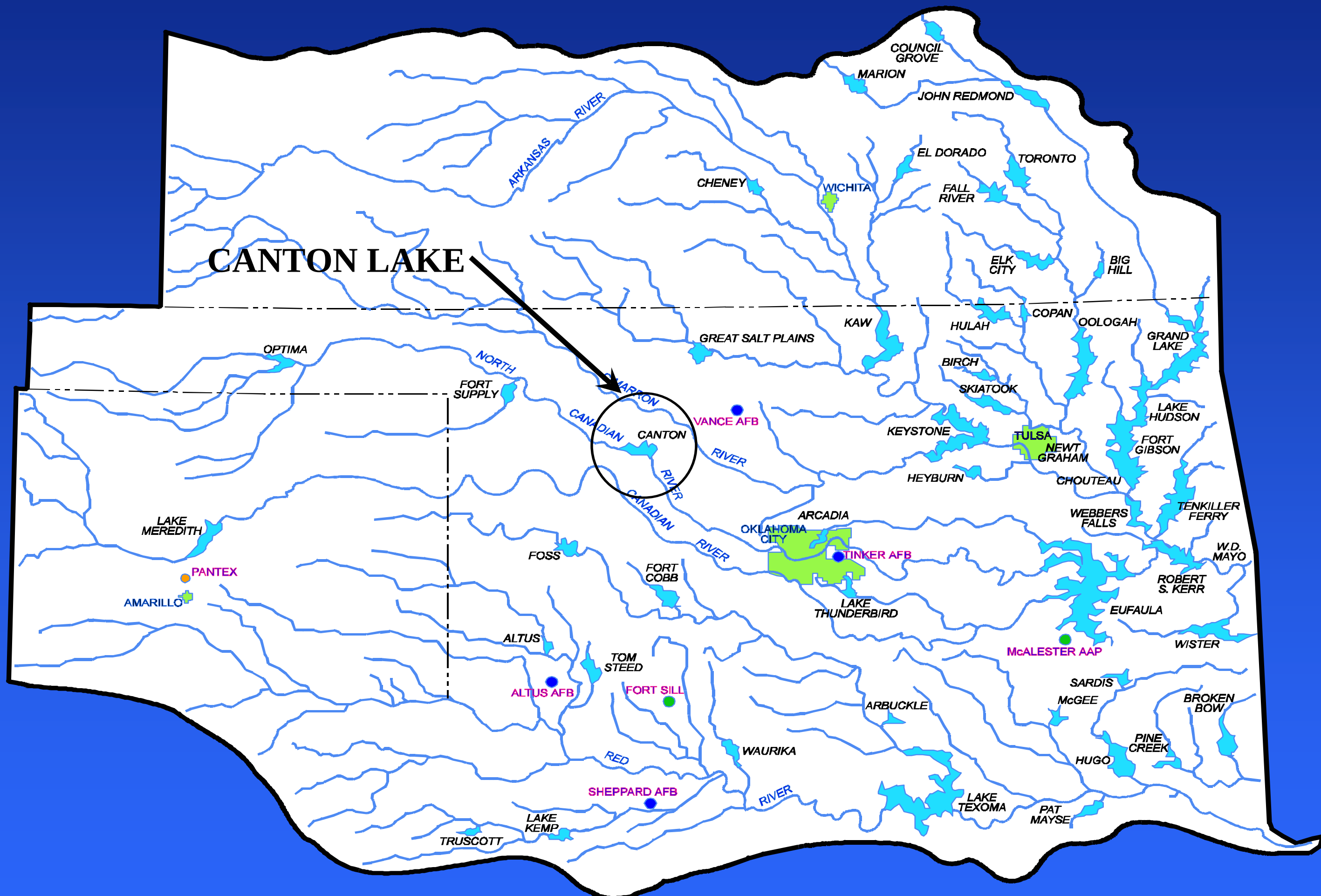

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of Engineers

CANTON DAM

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CANTON DAM

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CANTON DAM
PROJECT DESCRIPTION

- Rolled Earthfill Embankment with a Length of 15,140 ft. and max. height of 73 ft.
- Gate Controlled Concrete Chute Spillway with 16 - 40 ft. wide by 25 ft. high Tainter Gates with a Total Capacity of 274,000 cfs.
- Outlet Works Consists of 3 - 7 ft. wide by 12 ft. high sluice gates.
- Downstream Channel Capacity is Approx. 1000 cfs.

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CANTON DAM
PERTINANT DATA

• Top of Dam	1648.0
• Top of Flood Control Pool and Top of Spillway Gates	1638.0
• Top of Conservation Pool	1615.4
• Pool Restriction	1626.0

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CANTON DAM
DAM SAFETY ISSUES

- HYDROLOGIC DEFICIENCY
- SEISMIC DEFICIENCY
- SEEPAGE DEFICIENCY
- SPILLWAY STABILITY

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CANTON DAM
SPILLWAY STABILITY

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FOUNDATION MATERIALS

- PERMIAN RED BEDS
  - RUSH SPRINGS SANDSTONE
  - DOG CREEK SHALE
    - COMPACTION SHALE
    - POORLY INDURATED
    - GYPSUM LAYERS
    - SOFT LAYERS
  - BLAINE FORMATION
    - COMPACTION SHALE
    - 2 MASSIVE GYPSUM/ANHYDRITE LAYERS

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DOG CREEK SHALE STRENGTH CHARACTERISTICS

- OVERCONSOLIDATED
- DILATES WHEN SHEARED (AT LOWER CONFINING PRESSURE)
- LOWEST STRENGTHS 20-30 FEET, OR 1570-1580 ELEVATION, AND BELOW 50 FEET
- HIGHEST STRENGTHS BETWEEN 30 AND 40 FEET

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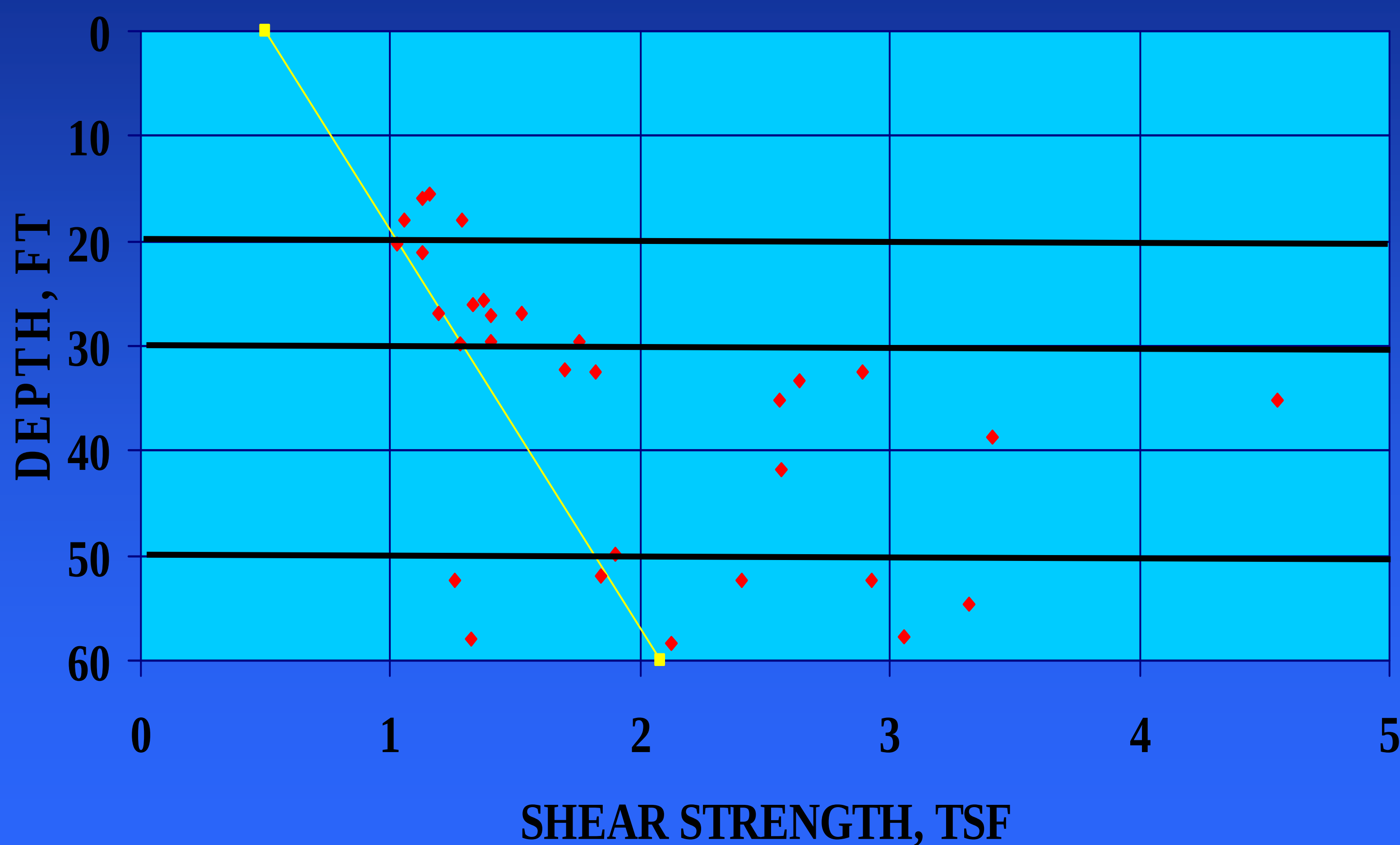
DATA FROM ALL SHEAR TESTS



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TECHNICAL CONCERNS

- **WEAK LAYERS IN FOUNDATION**
  - **GYPSUM SEAMS**
  - **OTHER SOFT SEAMS**
- **DESIGN SHEAR STRENGTH**
  - **USE OF COHESION**
- **DRAINAGE**
  - **50 PERCENT EFFECTIVE**
  - **0 PERCENT EFFECTIVE**

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LISTING OF SAFETY FACTORS

DATE	C	PHI	UPLIFT	FS
1944	880	31		2.38
1946	0	31		1.40
1973	600	30		1.39
1979	1200	50		2.16
1983	0	39.3	100%	0.88
1983	0	39.3	50%	1.2
1997	0	33	100%	0.7
1999	0	25	100%	0.55
1999	0	25	50%	0.88
2004	0	25	100%	0.50

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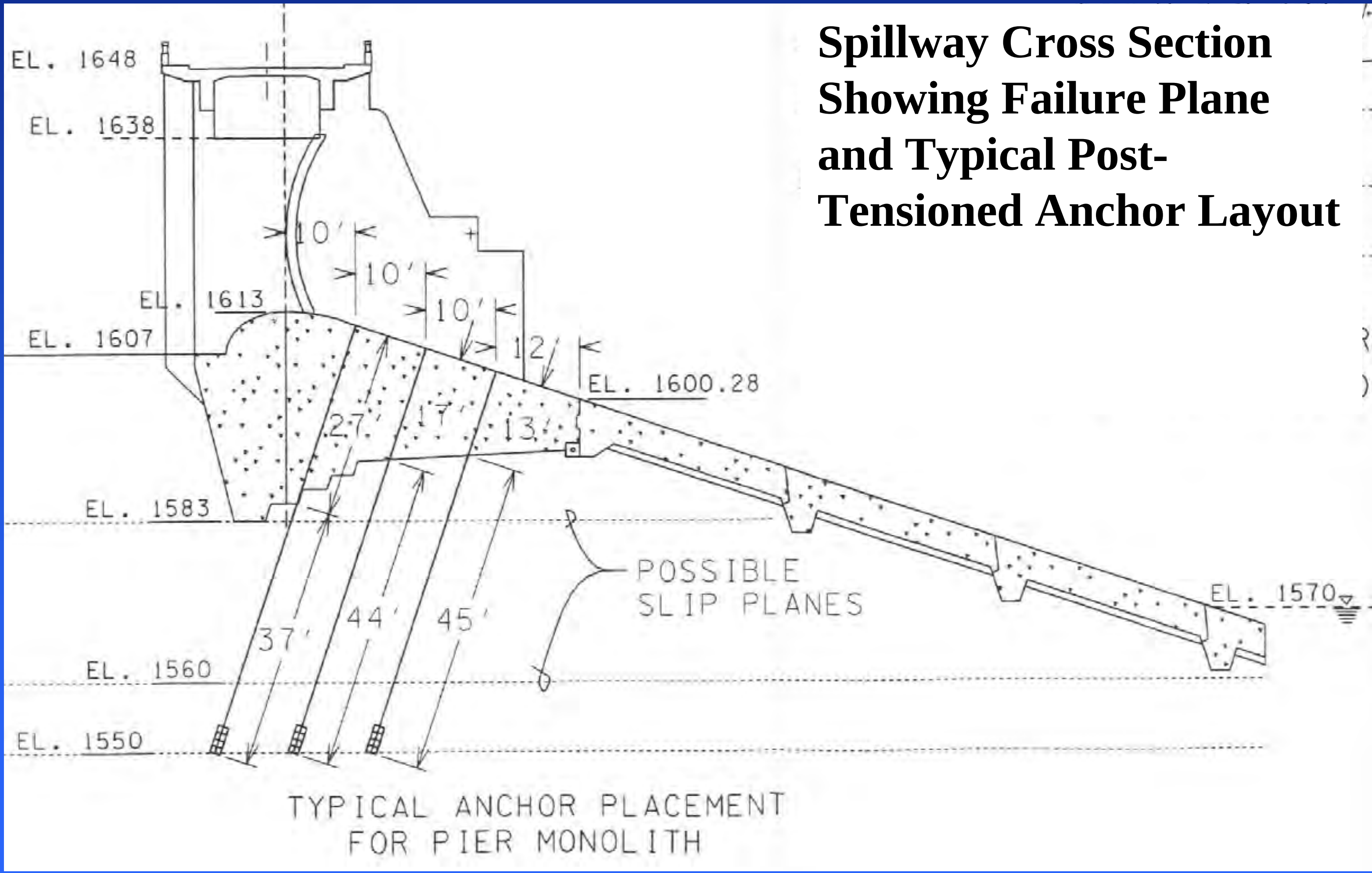
CANTON DAM
SPILLWAY STABILITY



Spillway Cross Section Showing Failure Plane and Typical Post-Tensioned Anchor Layout

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CANTON DAM SPILLWAY STABILITY

- **Determining Anchor Capacity**

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ANCHOR DESIGN LOAD FORMULA

$$P = \tau_w * L_b * \pi * d$$

P = design load for the anchor

τ_w = working bond stress along the interface between rock and grout

τ_w = 50% of the ultimate bond stress

L_b = bond zone length

d = diameter of drill hole

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RECOMMENDED BOND STRESS VALUES FROM PTI

ROCK	AVERAGE ULTIMATE BOND STRESS-ROCK/GROUT (PSI)
Granite and Basalt	250 – 450
Dolomitic Limestone	200 – 300
Soft Limestone	150 – 200
Slates & Hard Shales	**120 – 200**
Soft Shales	**30 – 120**
Sandstones	**120 – 250**
Weathered Sandstones	**100 – 120**
Chalk	30 – 155
Weathered Marl	25 – 35
Concrete	200 – 400

Table 6.1, Recommendations for Prestressed Rock and Soil Anchors, PTI, 1996

TEST ANCHOR PROGRAM
PHASE I CORE STRENGTHS

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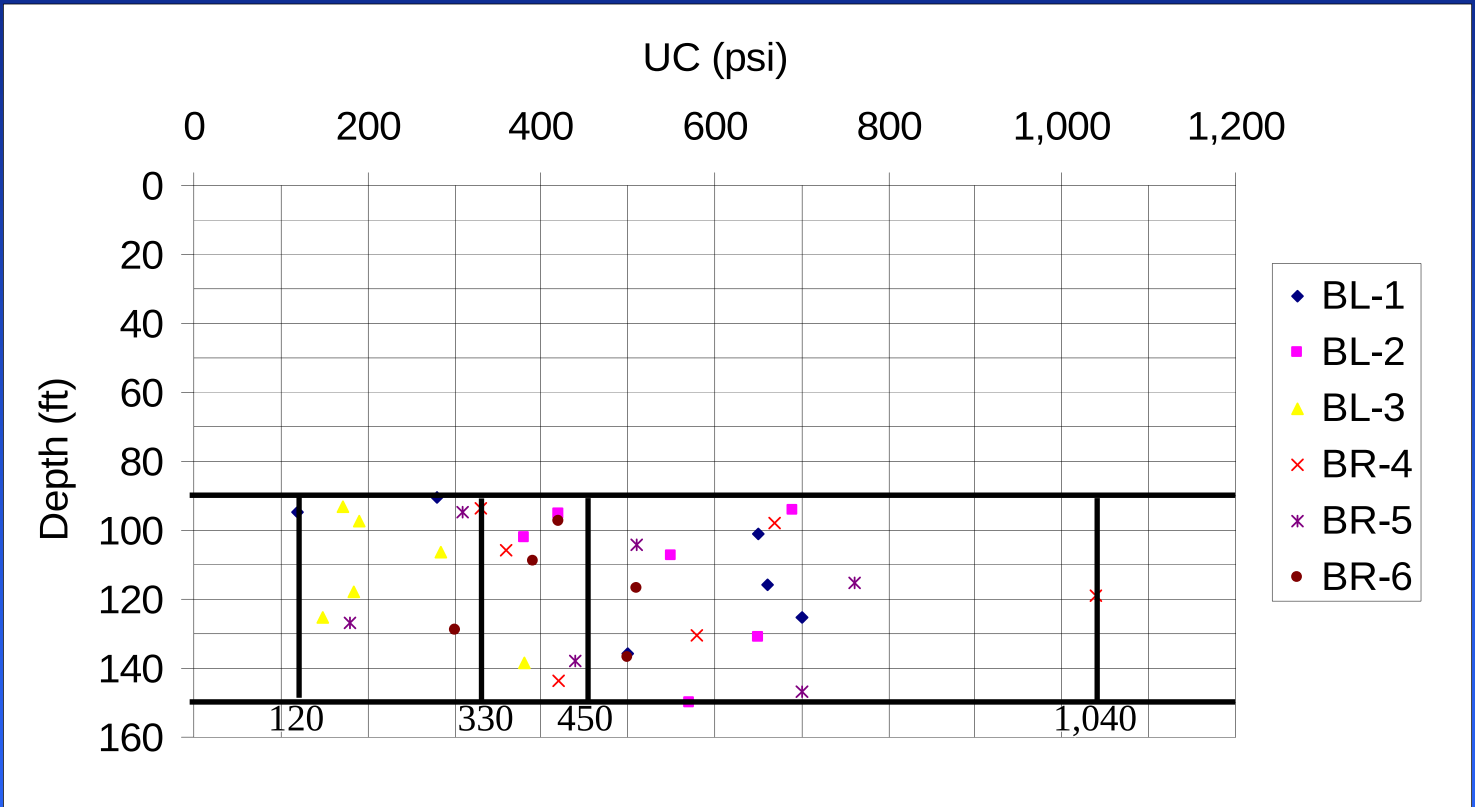

Minimum = 120 psi **Maximum = 1,040 psi**

One Third = 330 psi

Median = 420 psi **Average = 456 psi**

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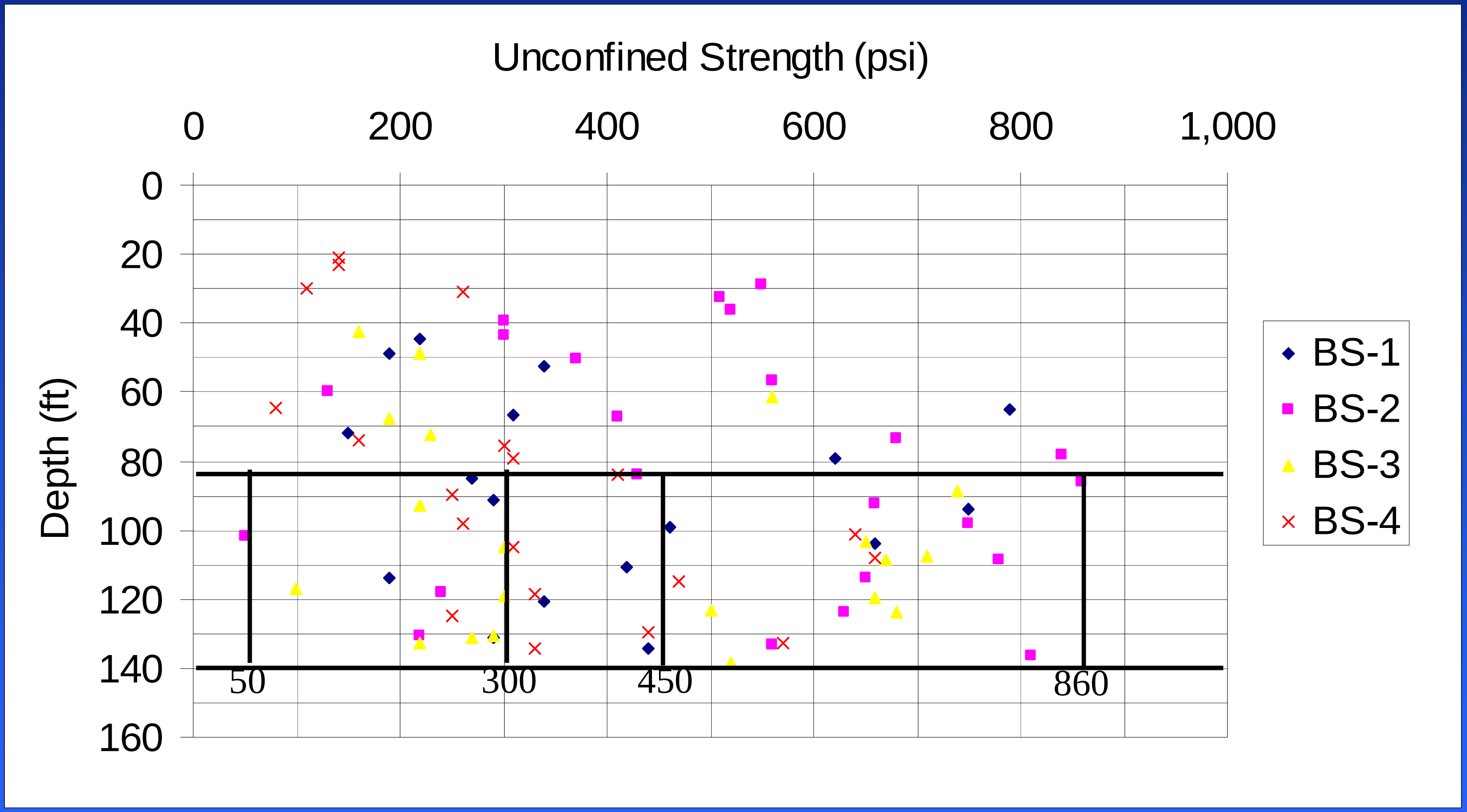
TEST ANCHOR PROGRAM PHASE II CORE STRENGTHS



Minimum = 50 psi **Maximum = 860 psi**

One Third = 300 psi

Median = 440 psi **Average = 460 psi**

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TEST ANCHOR PROGRAM
PHASE I & II SUMMARY

- Ultimate Bond Stress = 10% of the Unconfined Compressive Strength of the Rock
- Minimum Value = 5 to 12 psi
- One Third Value = 30 to 33 psi
- Median Value = 42 to 44 psi
- Average Value = 46 psi
- Maximum Value = 86 to 104 psi

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TEST ANCHOR PROGRAM
LAB BOND TESTS

Boring	Maximum Bond Stress (psi)	Boring	Maximum Bond Stress (psi)
BL-1	102	BR-4	104
BL-1	57	BR-4	233
BL-2	81	BR-5	176
BL-2	84	BR-5	62
BL-2	141	BR-6	154
BL-3	98	BR-6	65
BL-3	76	BR-6	300

Minimum = 57 psi

Maximum = 300 psi

One Third = 80 psi

Median = 100 psi

Average = 109 psi

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TEST ANCHOR PROGRAM
PHASE I PULLOUT TESTS

Boring	Bond Zone Length (ft)	No. of Strands	Percent of Design Load (%)	Bond Stress (psi)
A-1LA	15	7	118	63
A-1RA	15	7	165	97
A-3L	15	7	160	94
A-3R	15	7	155	91
A-2L	15	16	188	221
A-2R	15	16	190	224
A-5L	15	16	188	221
A-5R	15	16	190	224
A-4L	40	16	133	83
A-4R	40	16	133	83

No anchors failed during pullout tests

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of Engineers

CANTON DAM
SPILLWAY STABILITY

- **Investigation and Test Anchor Program**

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INVESTIGATION AND TEST PROGRAM

- Two phase test program required due to lack of funding
- Phase I – abutment drilling
  - 6 core holes
  - 8 anchor pullout tests
  - 2 anchor creep tests
- Phase II – spillway drilling
  - 4 core holes
  - 2 full scale anchor tests
- Awarded task orders for investigations and test anchors to MACTEC (Prime) and Hayward Baker (Sub)

TEST ANCHOR PROGRAM PHASE I

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- 3 core holes on each side of the spillway
  - 2 to 140 feet
  - 1 to 180 feet (top of gypsum)
- 2 test anchors on each side of spillway
  - 105 and 140 feet deep
  - 6 inch diameter hole
  - 7 strand tendon instrumentation
  - 15 foot bond zone
  - Perform pullout test to failure
    - Could not fail anchors

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TEST ANCHOR PROGRAM
PHASE I - INVESTIGATION

TEST ANCHOR PROGRAM
PHASE I - INVESTIGATION

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US Army Corps of Engineers

TEST ANCHOR PROGRAM
PHASE I - INVESTIGATION

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of Engineers

TEST ANCHOR PROGRAM
PHASE I - INVESTIGATION

FINDINGS

- Original boring logs indicated caved material
- Caved material turned out to be the result of dissolution and collapse
- Noticeable increase in core recovery, RQD, and strength of core below 90 feet
- Rock dips slightly to the southwest

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TEST ANCHOR PROGRAM
PHASE I

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TEST ANCHOR PROGRAM
PHASE I


TEST ANCHOR PROGRAM
PHASE I

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TEST ANCHOR PROGRAM PHASE I REVISED

- 2 test anchors on each side of spillway
  - 105 feet deep (one grouted and one not grouted)
  - 6 inch diameter hole
  - 16 strand tendon
  - 15 foot bond zone
  - Perform pullout test to failure
- 2 test anchor on each side of spillway
  - 105 feet deep
  - 6 inch diameter hole
  - 16 strand tendon with instrumentation
  - 40 foot bond zone
  - Conduct performance test and creep test

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TEST ANCHOR PROGRAM
PHASE I REVISED

TEST ANCHOR PROGRAM PHASE I REVISED

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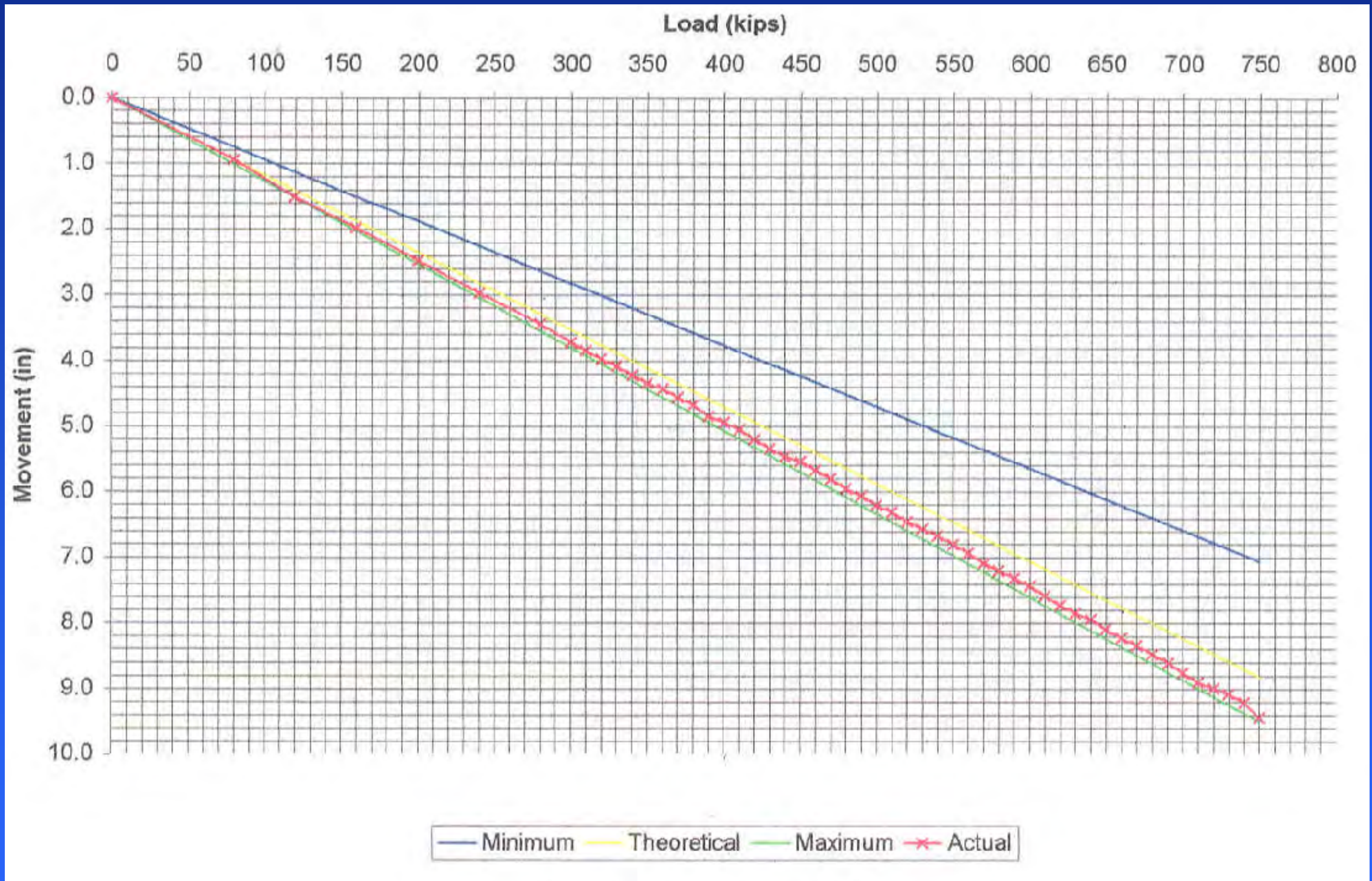

Load vs. Movement Graph

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TEST ANCHOR PROGRAM
PHASE I REVISED

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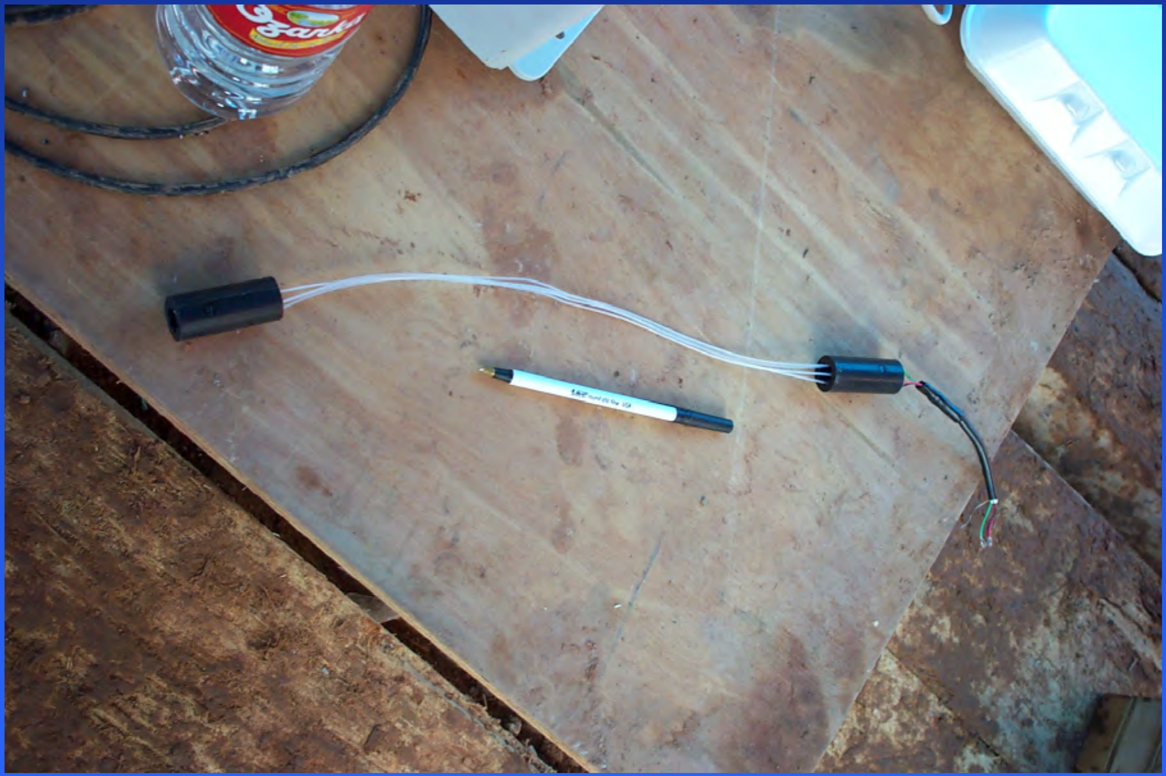
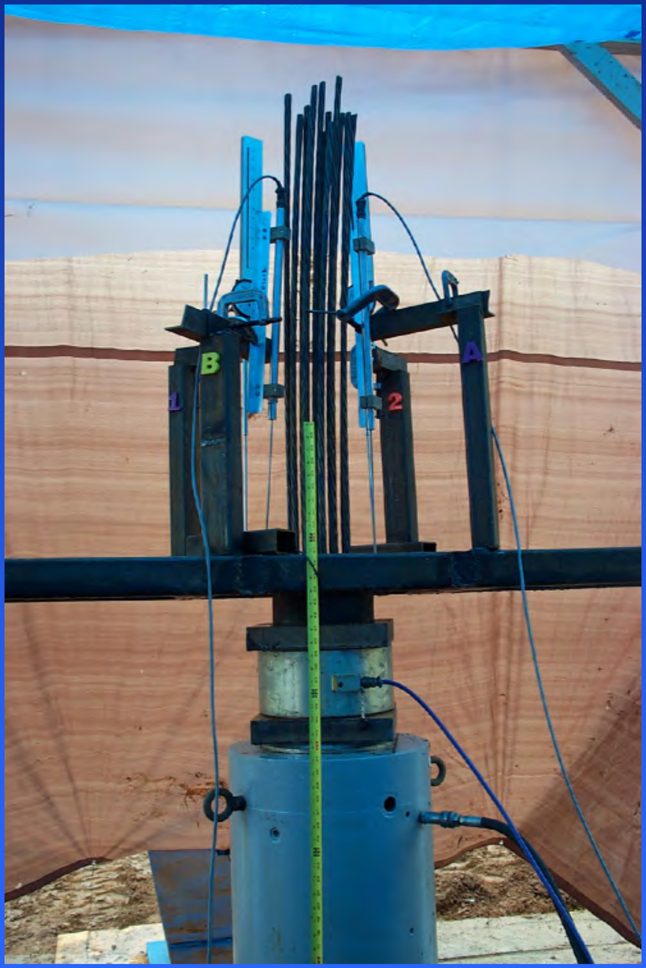
TEST ANCHOR PROGRAM
PHASE I REVISED





TEST ANCHOR PROGRAM
PHASE I REVISED

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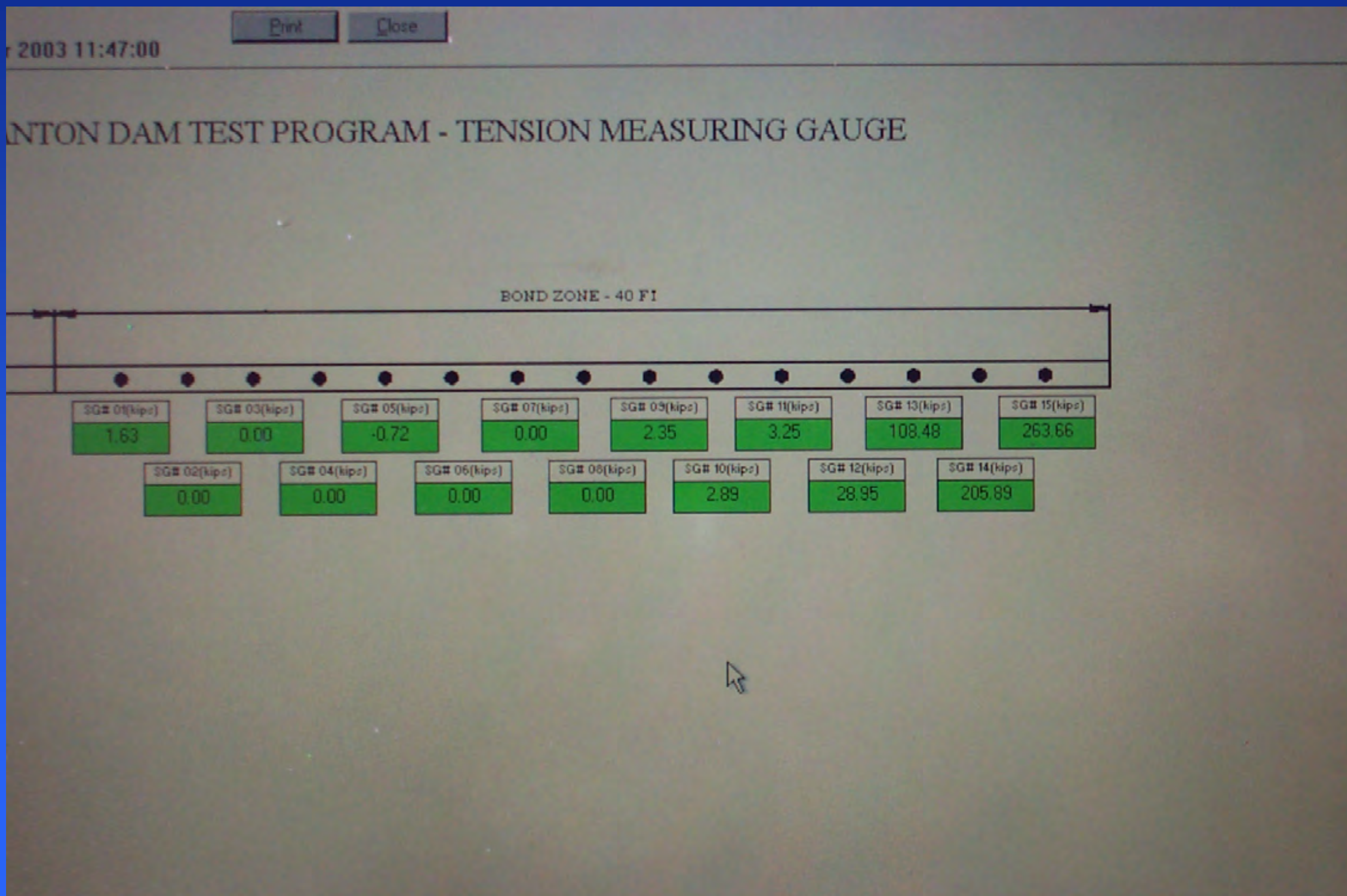

TEST ANCHOR PROGRAM
PHASE I REVISED

US Army Corps
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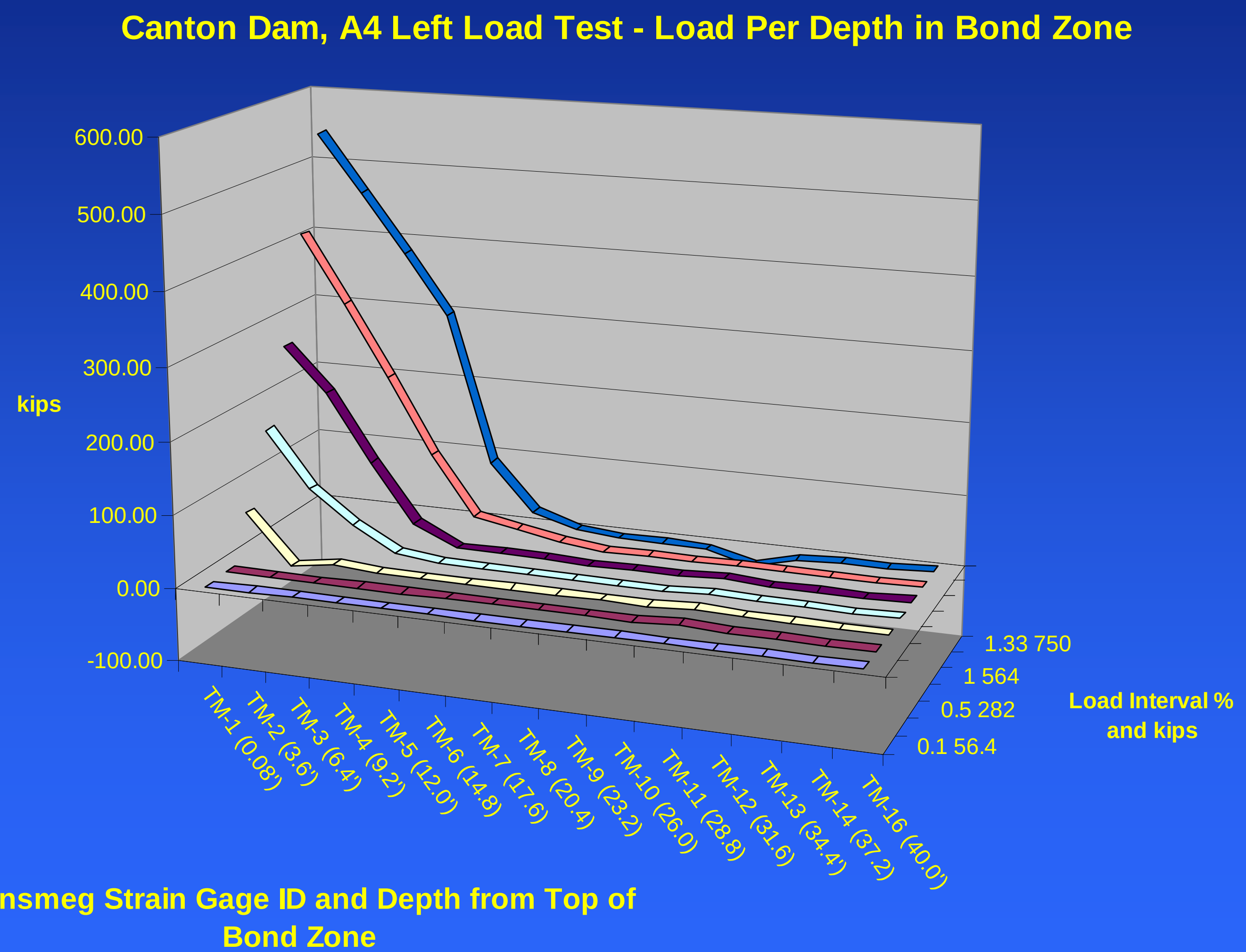

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TEST ANCHOR PROGRAM
PHASE I REVISED

US Army Corps
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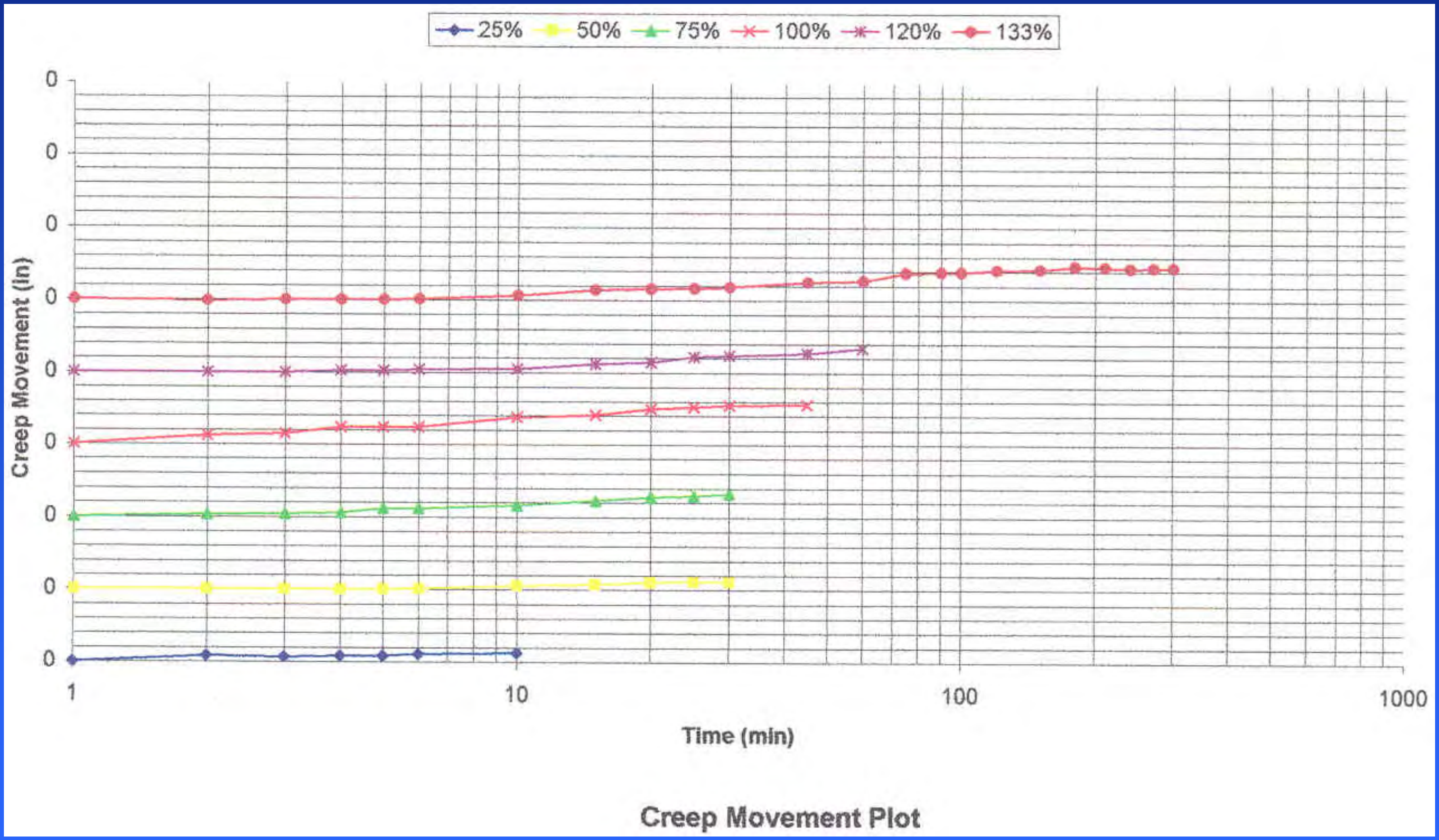

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TEST ANCHOR PROGRAM PHASE II

- Core 4 investigation holes in spillway to an elevation of 1460
  - Collect and test samples for strength and consolidation
- 2 production anchors at gate 16 in existing spillway
  - One 32 strand anchor drilled at 18.4^{o} to elevation 1470
  - One 28 strand anchor drilled at 30.0^{o} to elevation 1470
  - 12 inch diameter hole
  - 40 foot bond zone
  - Conduct performance test and creep test

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ANCHOR INVESTIGATION
PHASE II

ANCHOR INVESTIGATION PHASE II

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ANCHOR INSTALLATION
PHASE II

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ANCHOR INSTALLATION
PHASE II

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ANCHOR INSTALLATION
PHASE II

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ANCHOR INSTALLATION
PHASE II

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ANCHOR INSTALLATION PHASE II

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ANCHOR INSTALLATION PHASE II FINDINGS

- Weir access is difficult
  - Slick surface
  - Tight workspace
  - Load limit on spillway bridge
- Continuous flow of cuttings is required
  - Falling cuttings blocked hole and drill tools
- Hole will cave in 12 to 24 hours
  - Duplex type casing would be ideal but none exists for this size of hole
- Control elongation of corrugated pipe
- Drill one hole and install corrugated pipe in that hole before starting another one

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ANCHOR INSTALLATION PHASE II FINDINGS

- Stage grout to avoid buckling corrugated pipe
- Measure top of grout accurately to avoid clogging of other grout tubes
- Consider single stage vs. two stage grouting
- Label grout and flush tube adequately

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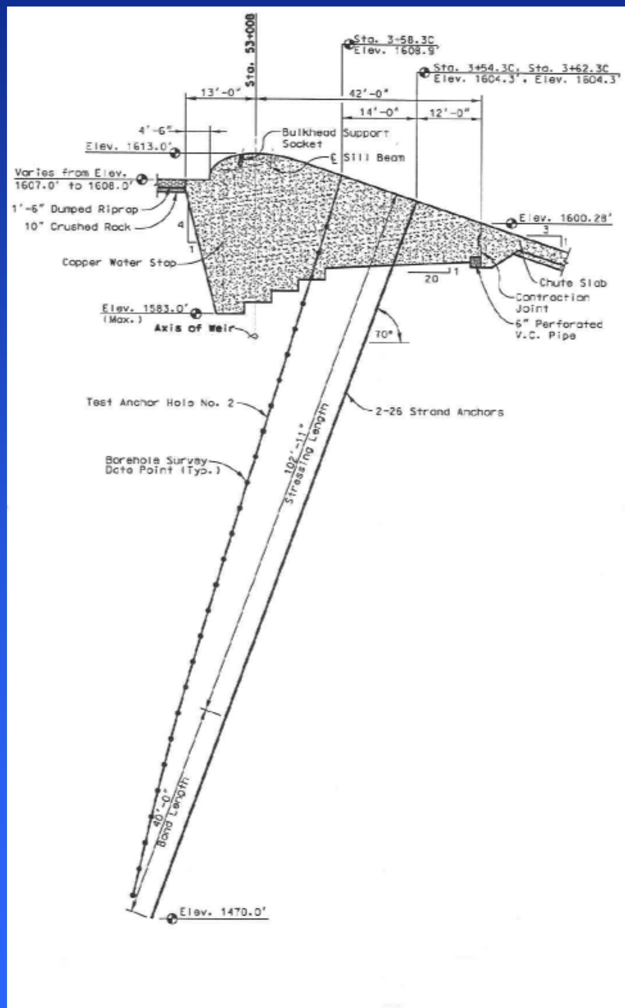
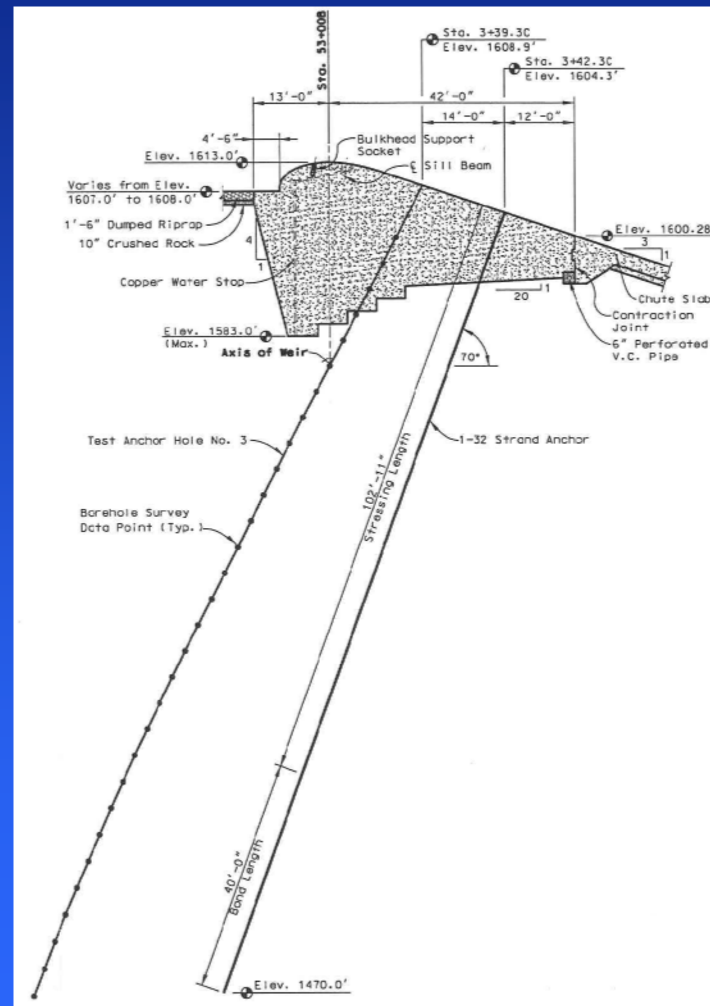
ANCHOR DESIGN





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CANTON DAM
SPILLWAY STABILITY

- **Summary**

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TEST ANCHOR PROGRAM SUMMARY

- Ultimate Bond Stress Values
  - From PTI Table = 30 to 120 psi
  - From Unconfined Compressive Strength Tests = 30 to 45 psi
  - From Lab Bond Tests = 80 to 110 psi
  - From Pullout Tests = 100 to 220 psi
    - No anchors failed during pullout test
  - Full scale anchor tests loaded to 133% of design load = 83 psi working bond stress

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TEST ANCHOR PROGRAM SUMMARY

- Total force required for weir section = 1,550 kips
  - 12 anchors would be required for an ultimate bond stress of 30 psi
  - 2 anchors are be required for an ultimate bond stress of 120 psi
- Total force required for pier section = 1,830 kips
  - 14 anchors would be required for an ultimate bond stress of 30 psi
  - 2 anchors are be required for an ultimate bond stress of 120 psi

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TEST ANCHOR PROGRAM PHASE I & II SUMMARY

- Phase I
  - Cost approximately $700,000
  - Reduced the number of anchors from over 400 to 112
  - Cost savings of over $6,000,000
- Phase II
  - Cost approximately $800,000
  - Reduced the number of anchors from over 112 to 64
  - Cost savings of over $2,000,000
- Total cost of $1,500,000
- Total savings over $8,000,000
- Return on the investment of more than 5 to 1

SPILLWAY STABILITY

US Army Corps
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CANTON LAKE

Is a Test Anchor Program Necessary?

It certainly was for us

Some considerations if you are thinking about a test program

- Consider the total load required per monolith
- Consider the type of rock
- Consider the configuration of the structure

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SPILLWAY STABILITY

CANTON LAKE

Tulsa District

Dam Safety Assurance Project
Is a Test Anchor Program Necessary?

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One Corps, One Regiment, One Team

US Army Corps of Engineers
Huntington District

Marmet Lock & Dam

Automated Instrumentation Assessment
Summer / Fall 2004

2005 Tri-Service Infrastructure Conference
August 4, 2005

Jeff Rakes 304-399-5809

Ron Adams, P.G. 304-949-1934

Considerations

- Project Overview
- Automated Data Acquisition System Overview
- ADAS Challenges
- Deep Seated Sliding Occurs
- ADAS Failure
- Emergency Action Plan Response
- Remediation Attempts
- Current Status

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Huntington District

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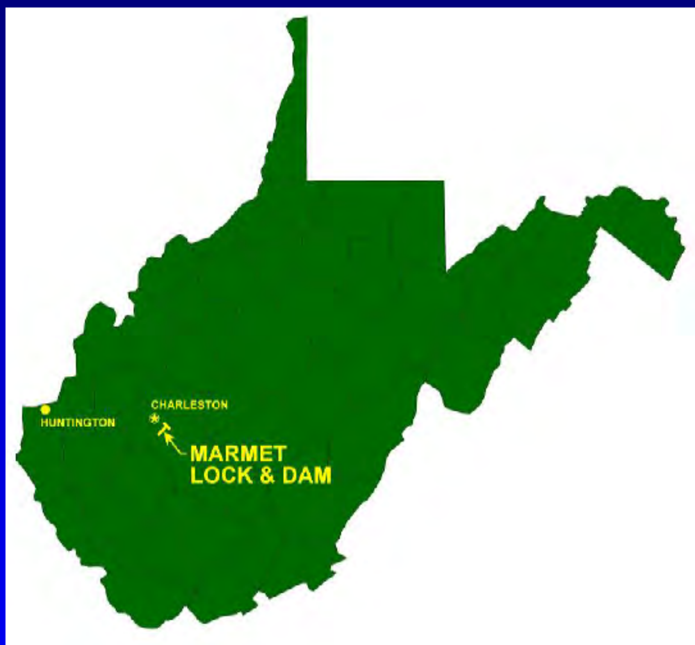
Project Overview

- Project Located On Kanawha River (Just SE Of Charleston, WV)
- Built In 1934 – Twin Locks 56’x360’
- Average Lock Time Is Over 4 Hours Per Tow
- Contract Awarded May 2002
  - Kokosing / Frucon, LLC (KFC)
- Estimated 7-year Construction
- New Lock Is 110’x800’



Project Location

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Huntington District

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Marmet Lock & Dam
Prior to New Lock Construction

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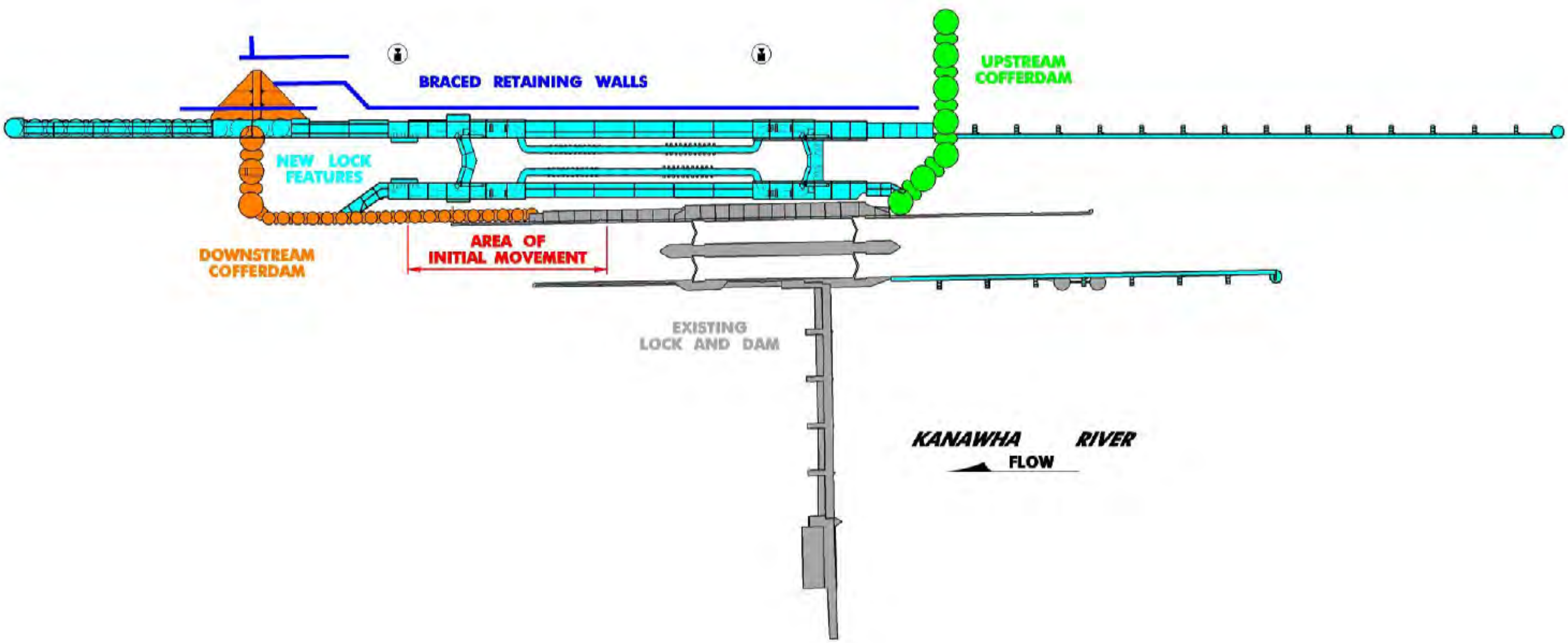
Huntington District



Marmet Lock - New Construction


Spoil Area
Downstream Cofferdam
Anchored Retaining Wall
Existing Lock Wall
Existing Lock
Dam
Upstream Cofferdam

Cofferdam at Time of Initial Movement

Cofferdam at Time of Initial Movement

Cofferdam at Time of Initial Movement


08/19/2004
Cofferdam at Time of Initial Movement

ADAS Overview

- Monitors Cofferdam Cells, Existing Lock Wall And Spoil Site
- Central Monitoring Station
- Geo-Net / Geo-View Website Computers
- 30 Remote Computers (MCU) (Measurement And Control Unit)
- 350+ Sensors Include:
  - IPI (In-Place Inclinometers)
  - Vibrating Wire Piezometers
  - Load Cells (On Anchors)
  - Digital Tilt Meters
  - Pool Transducers

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Huntington District

ADAS Overview

Manually Read Instruments

- Portable Inclinometers
- Settlement And Alignment Pins
- Joint Monitoring Pins
- Saw Cuts

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ADAS Overview

30 MCUs (Remote Computers) Installed on Site

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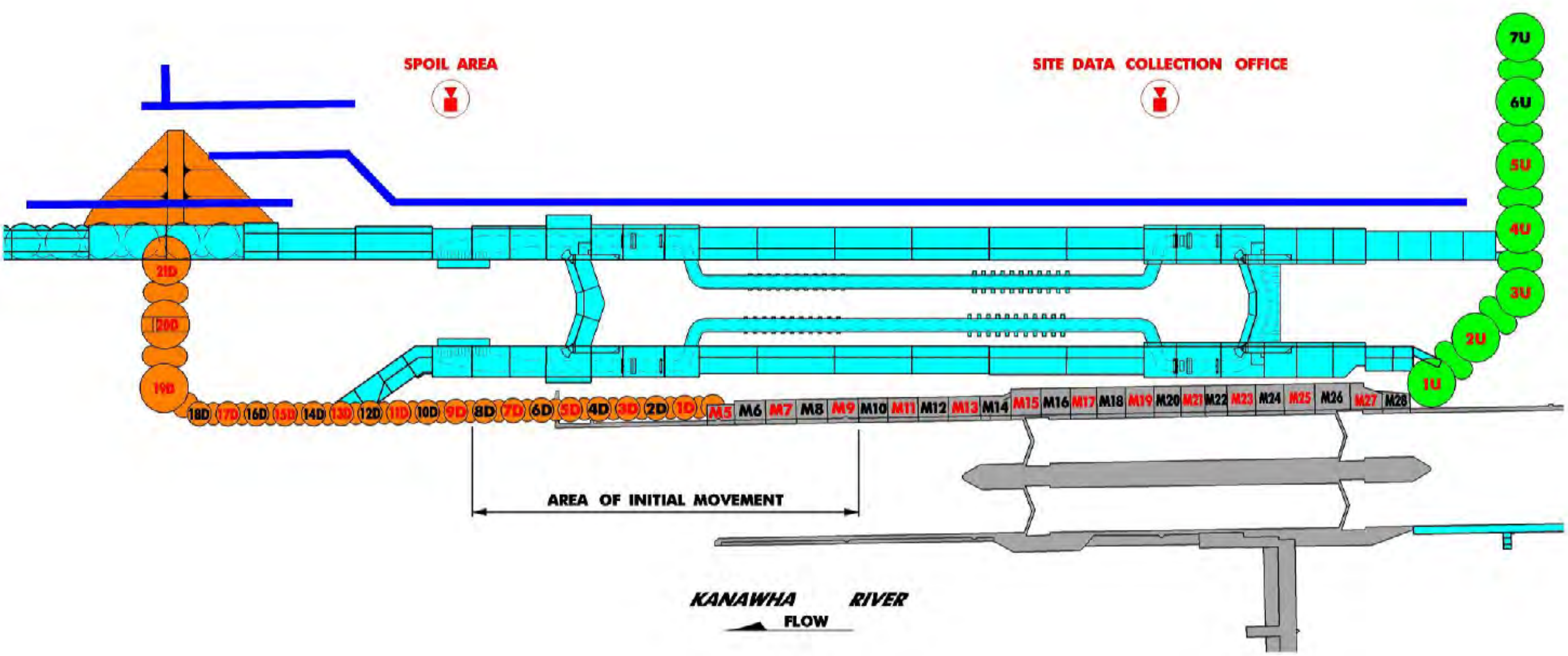
ADAS Overview



MCU Locations (Shown in Red)

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ADAS Overview
Cofferdam Cell Installations

Upstream Cells

Downstream Cells

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ADAS Overview
Lock Wall Installations

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ADAS Overview
Load Cells On Anchors

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ADAS Overview

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ADAS Challenges

- Grounding / Physical Location
  - MCUs Located On Cells And Existing Lock Wall
    - Kanawha River On West Side
    - Excavated Walls / Construction On East Side
    - No Good Location For Individual Grounds
    - Bare Copper Ground Wire Runs From Upstream Cell To Downstream Cell, Exposed Above Ground
    - Copper Ground Wire Fastened To Safety Fence
    - All Lock Wall MCUs Grounded To Same Copper Ground Wire

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ADAS Challenges
Grounding / Physical Location

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ADAS Challenges
Grounding / Physical Location

ADAS Challenges

- Communication Antenna Arrays
  - Two Large Communication Arrays Are Located Within 2-miles Upstream And Downstream Of Marmet Lock
  - The Arrays Both Transmit And Receive Signals Over A Wide Range Of Frequencies
- River Traffic Radio Transmissions
  - Lock To Barge Communications
- Hydroelectric Plant Control
  - Remote Communication Control
- All Data Transmission Is Performed Via Radio Between The MCUs And The Central Monitoring Station

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Huntington District

ADAS Challenges

- Limited On-site Expertise
  - Hardware And Software Support Is Provided By Off-site Sub-contractors
- Limited Experience With MCU / Software
  - Initial Installer And Programmer Had Limited Experience With Geomation Hardware / Software

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Huntington District

Deep Seated Sliding Occurs

- Construction Status At The Time Movement Occurs
  - All Rock Anchors And Thrust Blocks Had Been Installed
  - Drilling, Rock Blasting And Foundation Rock Excavation Had Begun In Downstream Area Of Cofferdam
  - Reading, Plotting And Evaluation Of Instrumentation Data Was An Ongoing Task

Deep Seated Sliding Occurs

- Initial Downstream Movement
  - August 2004 Movement Occurred Along Two Weak Planes
    - El 540 +/- Where There Is A Series Of Thin Seams Of Carbonaceous Shale And Coal Within An Otherwise Generally Competent Sandstone Formation
    - El 520 +/- Where There Is A Discontinuous Thin Seam Of Clayey Material Near The Bottom Of The Sandstone Unit And An Underlying Shale Formation. This Seam Is Slightly Lower Than Any Required Excavation

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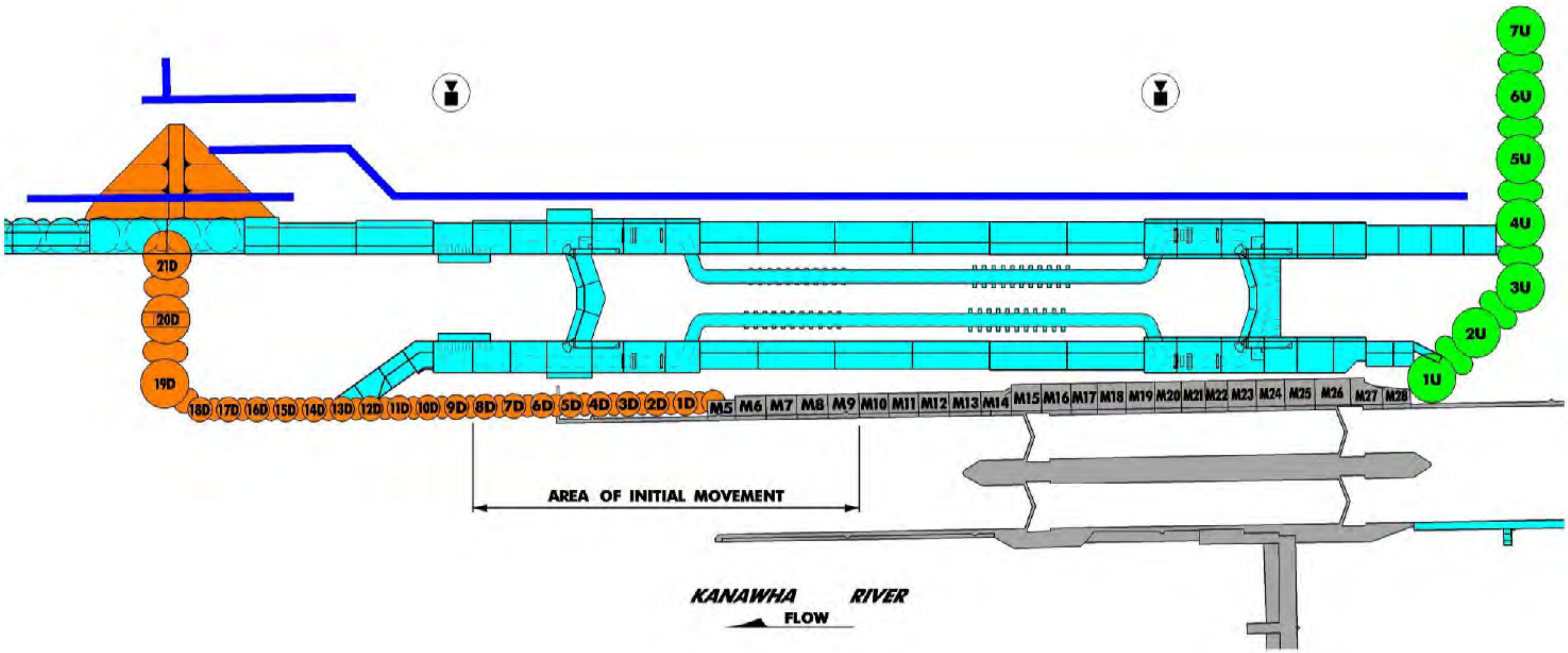
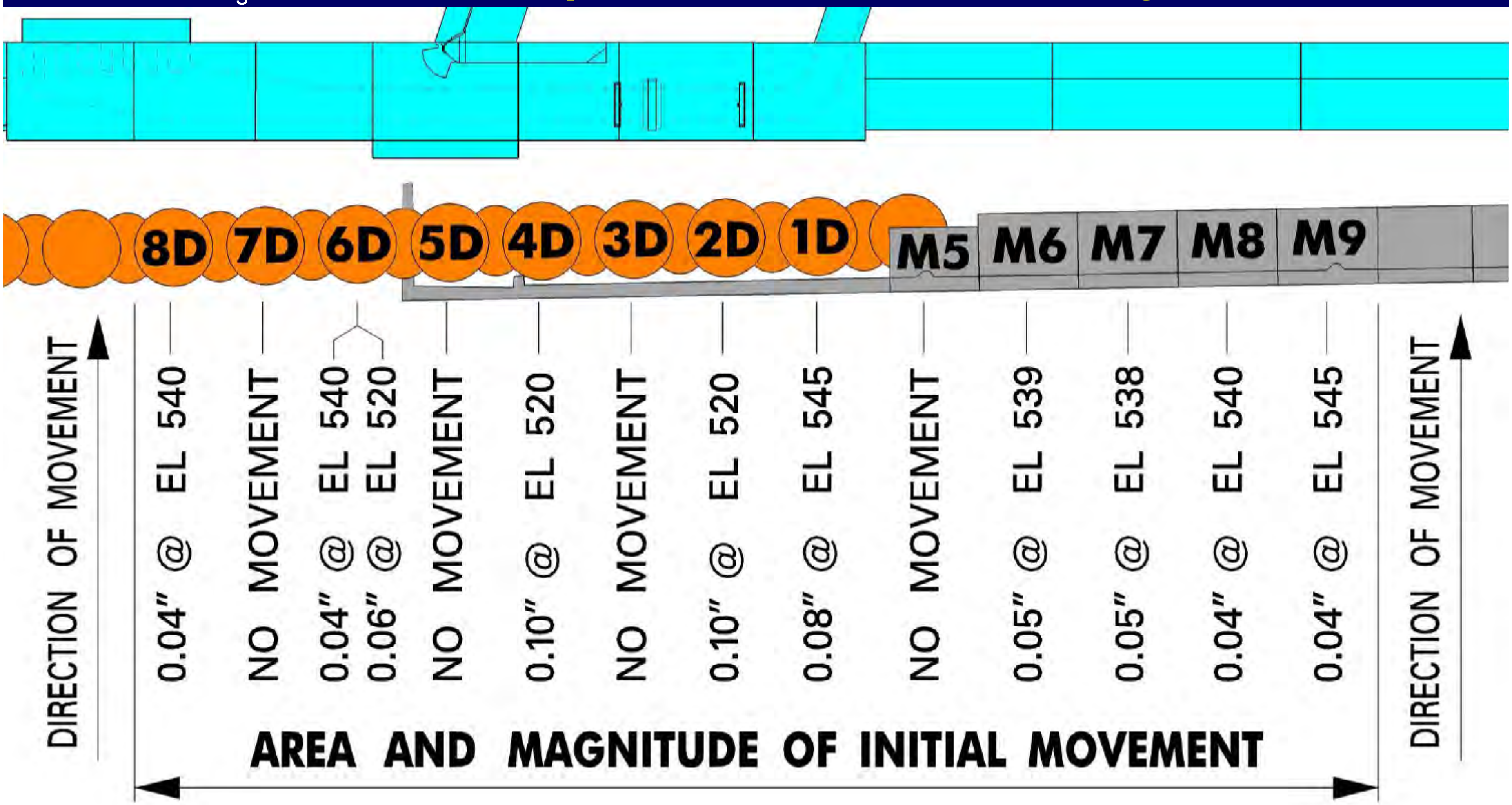
Deep Seated Sliding Occurs



Cofferdam Area

Deep Seated Sliding Occurs



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Deep Seated Sliding Occurs

- Initial Downstream Movement - Continued
  - The Magnitude Of The Movement Was Consistent With That Expected For The Initial Transfer Of Load As Estimated From Direct Shear Tests In The Foundation Rock
  - The Movement Was Generally Within Tolerable Limits; However The Consensus Of The PDT Was That The Trend Of Gradual And Steady Increases Warranted Concern And Additional Scrutiny

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Deep Seated Sliding Occurs

- Initial Downstream Movement - Continued
  - The Movement Stabilized Within 6-8 Weeks After Rock Blasting And Foundation Rock Excavation
  - The Initial Threshold Of 0.25“ Of Total Movement Was Revisited By The PDT And Deemed Reasonable And Appropriate.
- Additional Upstream Movement
  - Additional Upstream Movement Was Anticipated And Did Occur, But PDT Response Actions Minimized The Magnitude Of That Movement.

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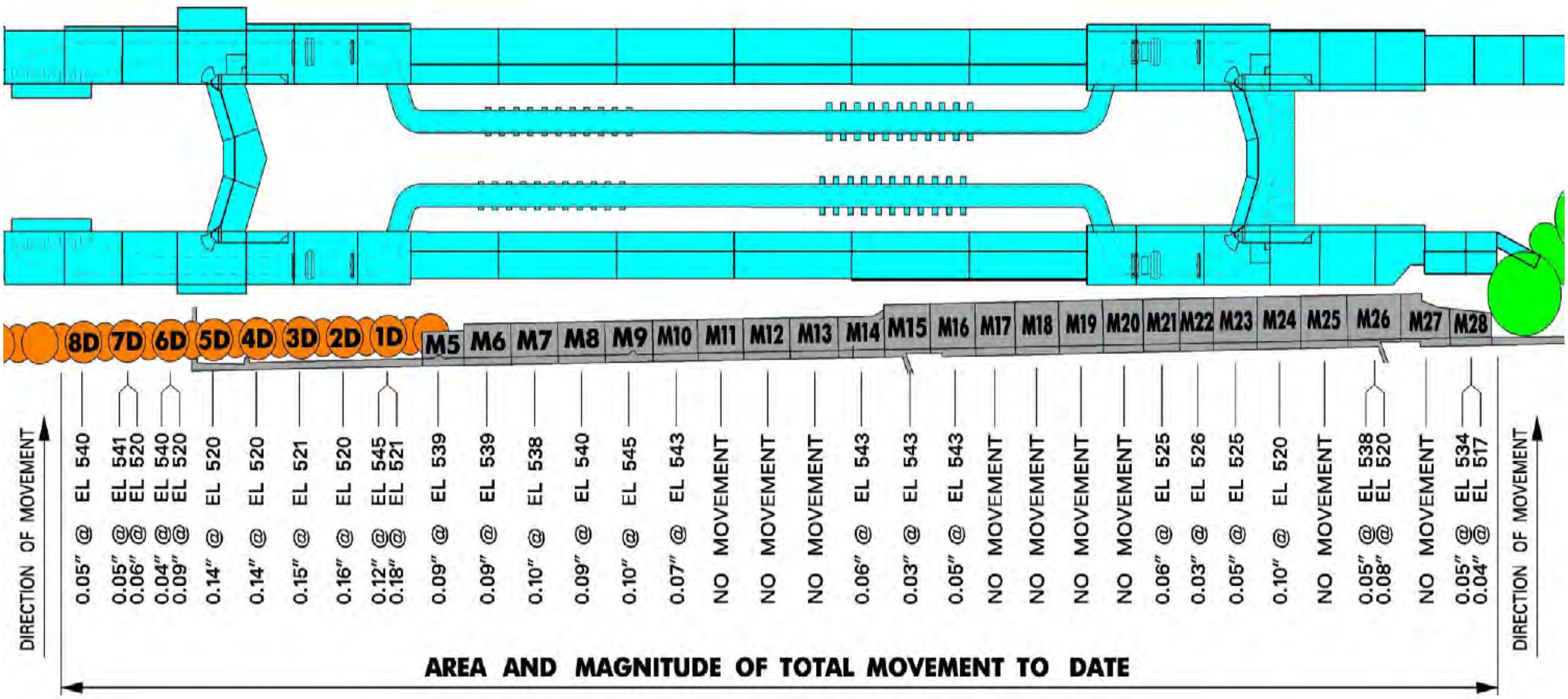
Total Movement To Date



ADAS Failure

- Reliability Of The ADAS Had Been Suspect For Some Time
  - Significant Disagreements Between IPI And Portable Inclinometer Readings
  - IPI Readings Had Provided Erratic Results
  - Excessive Number Of False Alarms
  - Monthly Instrumentation Reports Regularly Contained Graphs With Considerable Gaps In Recorded Data And Readings That Significantly Exceeded Established Threshold Limits

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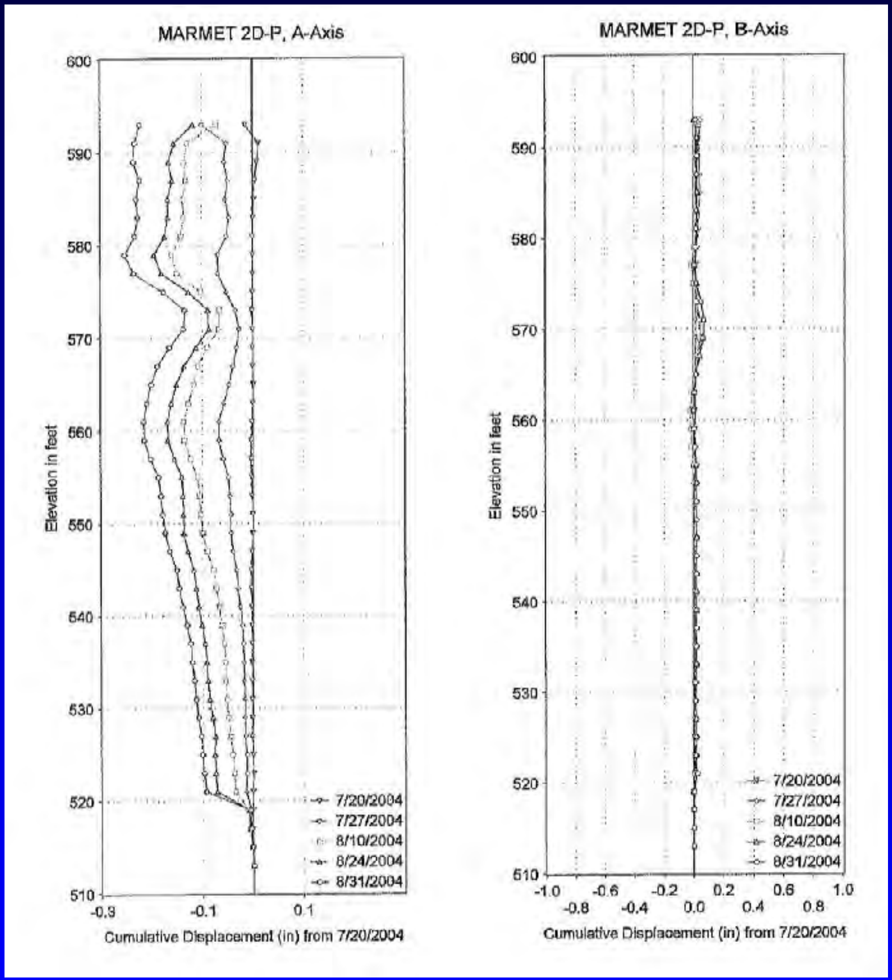
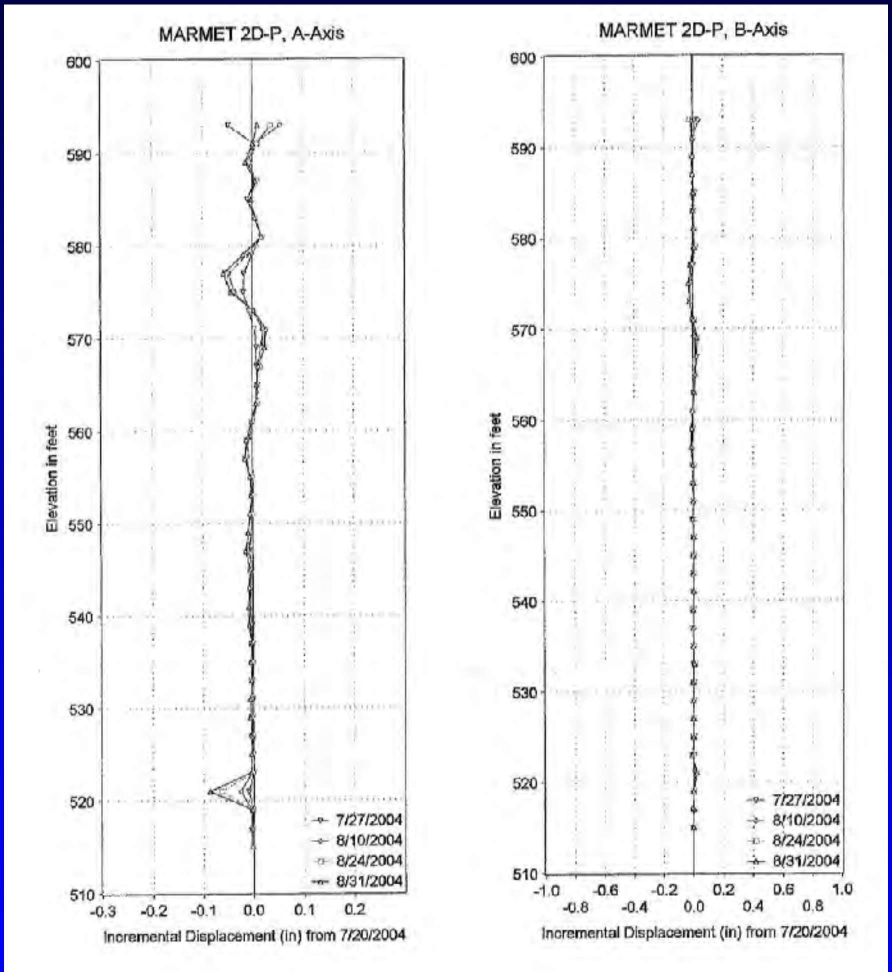
ADAS Failure

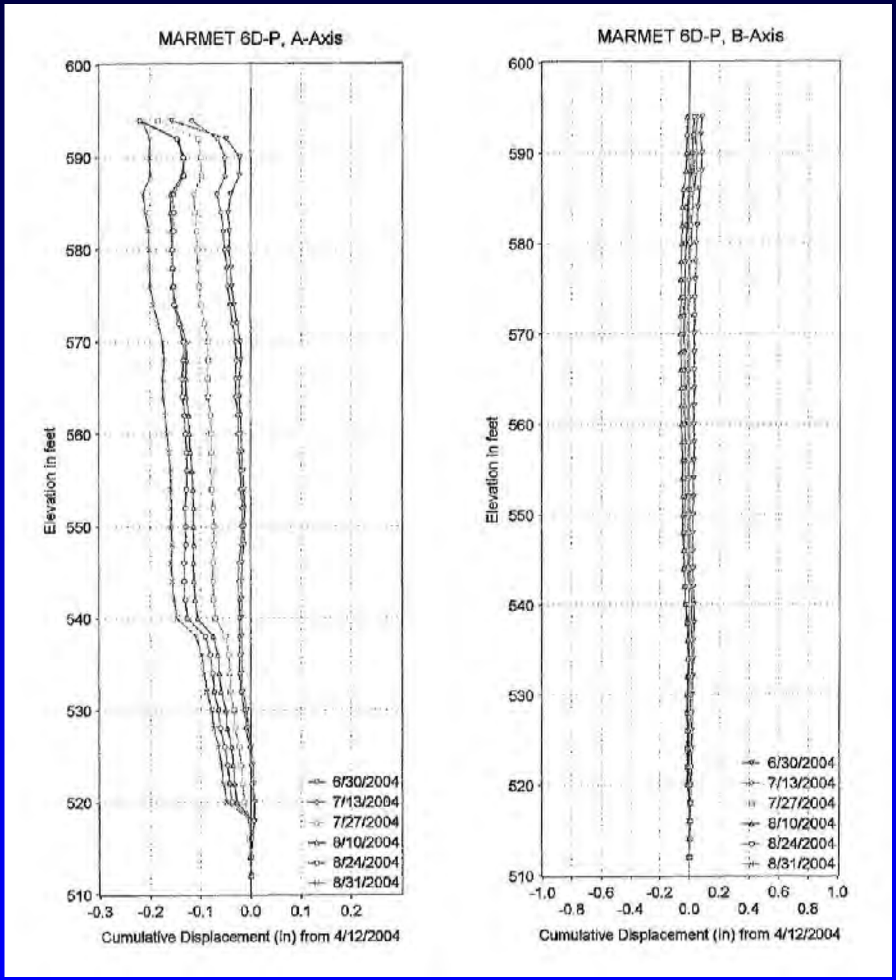
- August 31, 2004 Special Meeting
  - Contractor Provides COE With Portable Inclinometer Graphs Indicating Movement In Foundation Below Several Monoliths And Cells
  - Movement Elevations Correlated With Previously Identified Weak Seams And Occurred In Four Consecutive Weekly Readings
  - Movement Was Recorded In Graphs For A Number Of Adjacent Cells And Monoliths
  - Movement Was Oriented Landward And Occurred A Few Weeks After Blasting And Excavation Of Adjacent Foundation Rock Had Begun
  - Rate Of Movement Was Consistent And Linear (0.01” To 0.02” Per Week)

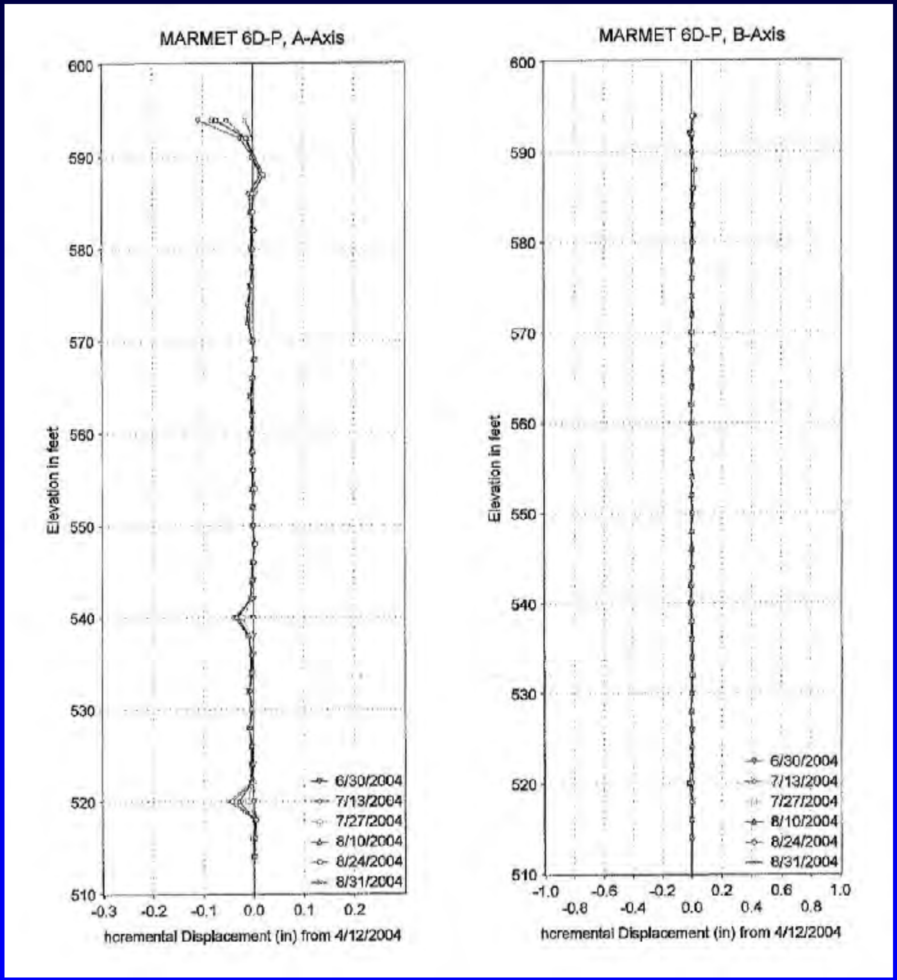




Initial Movement – Cell 2D

August 2004





Initial Movement – Cell 6D

August 2004

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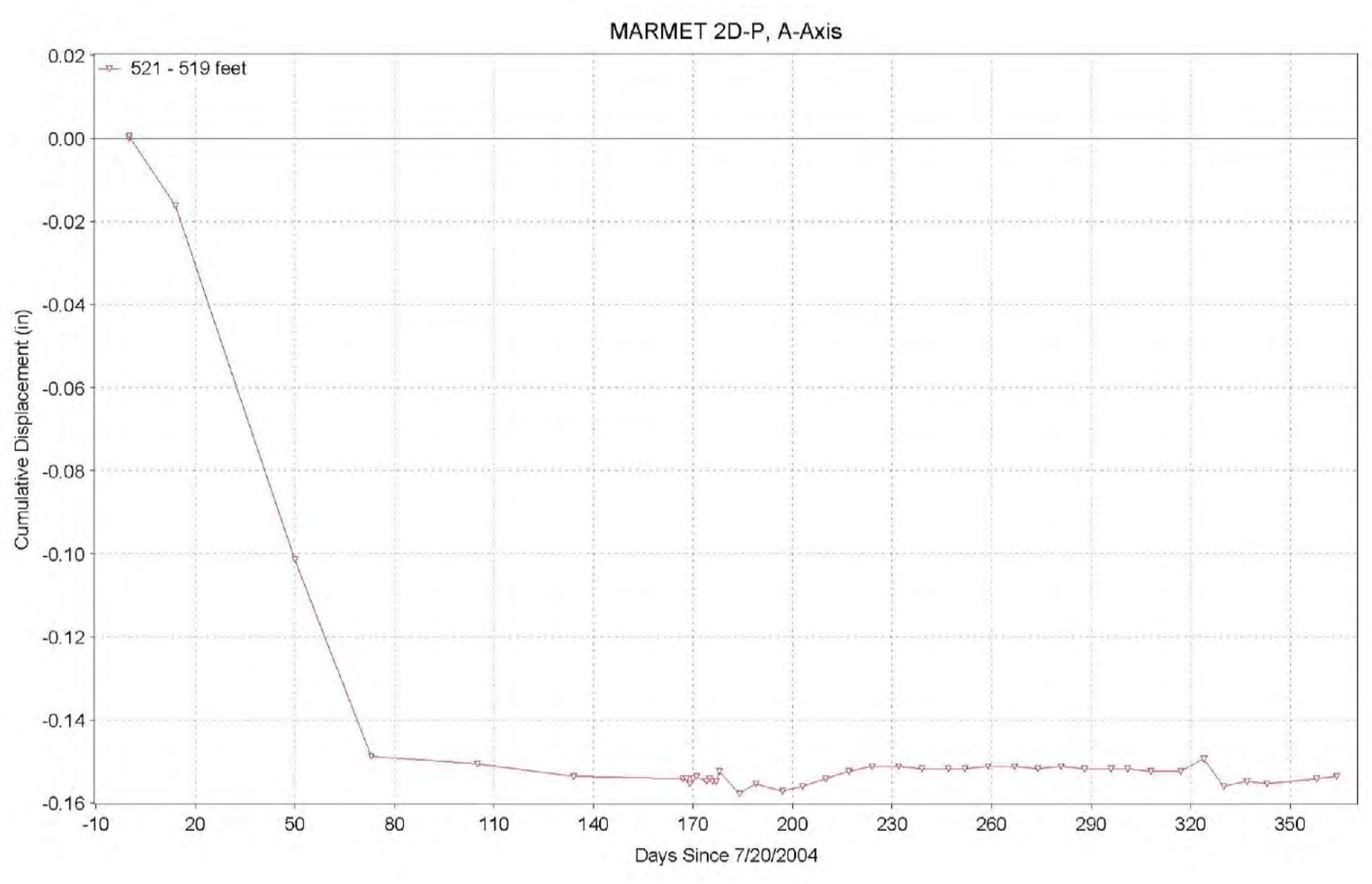

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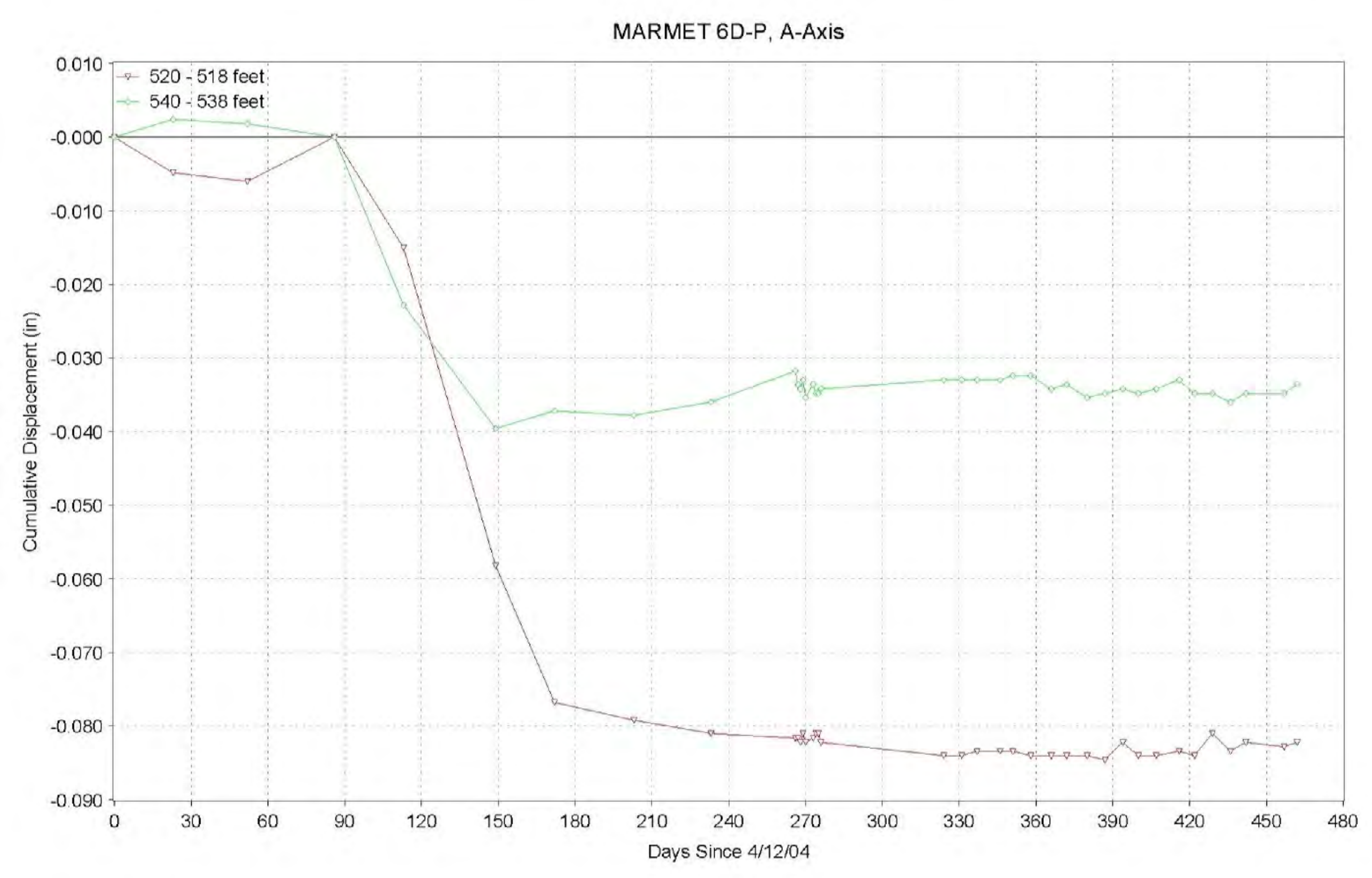

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ADAS Failure

- Resulting Actions
  - The Readings Recorded By The ADAS Did Not Correlate With The Movement Identified By The Portable Inclinometer Surveys And Validated COE Concerns
  - The Lack Of Confidence In The ADAS Resulted In An Increase In The Number And Frequency Of Portable Inclinometer Readings And Resulting Evaluation Of That Data
  - COE Directed The Contractor To Perform An Investigation Of The ADAS
  - While Some Movement Was Expected, The PDT Developed An “Emergency Action Plan” To Provide Guidance If The Movement Exceeded Anticipated Levels

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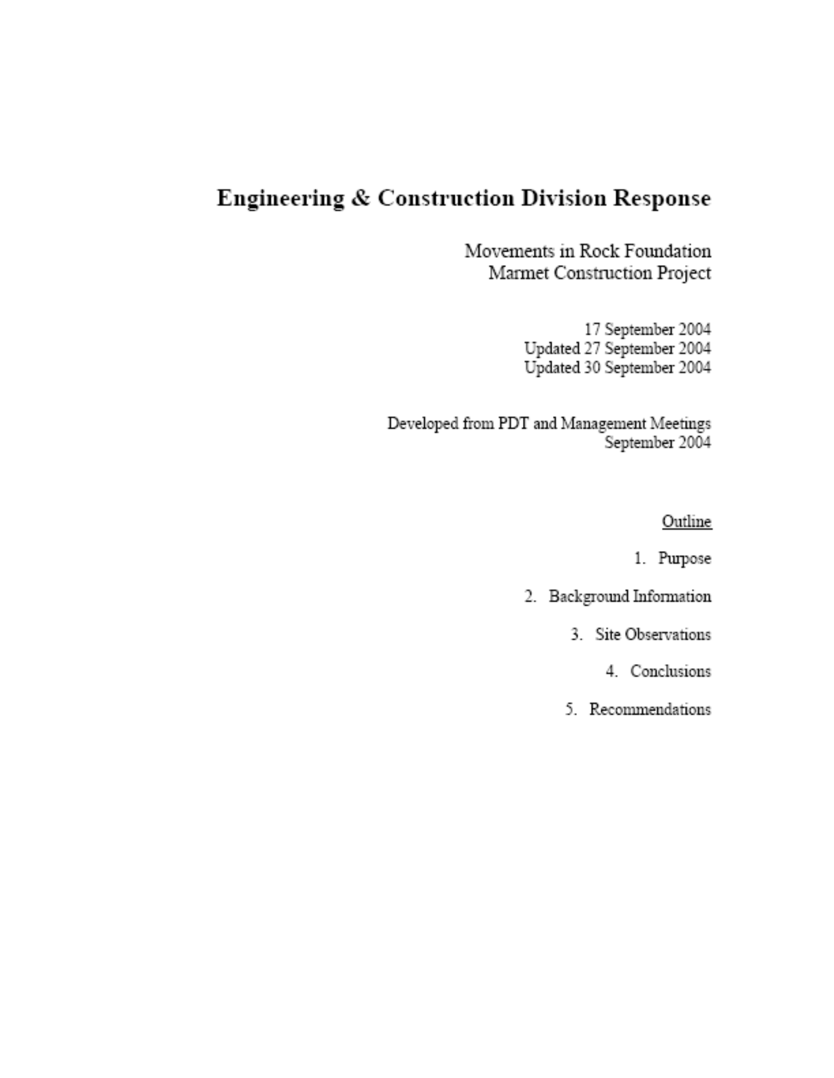
E.A.P. Response



Engineering & Construction Division Response

Movements in Rock Foundation
Marmet Construction Project

17 September 2004
Updated 27 September 2004
Updated 30 September 2004

Developed from PDT and Management Meetings
September 2004

Outline

1. Purpose
2. Background Information
3. Site Observations
4. Conclusions
5. Recommendations

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Huntington District

E.A.P. Response

- Recommended Actions Of The PDT
  - Increase Frequency Of Instrumentation Readings And Evaluation Of Data
  - Reanalyze Additional Failure Planes Within The Rock Foundation
  - Complete Second Stage Grouting Of Anchors
  - Add Additional Upstream Anchors
  - Add Additional Inclinometers Of Greater Depth And At Additional Locations
  - Improve Reliability Of Instrumentation System

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E.A.P. Response

- Recommended Actions Of The PDT – Continued
  - Obtain Additional Technical Oversight (Engineering Geology Experts, RTS, Etc)

    (Instrumentation Experts)
  - Evaluate Alarm Thresholds For Load Cells
  - Establish Displacement Thresholds And Stabilizing Actions

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Remediation Attempts

- Instrumentation Summit #1 (Sept 2004)
  - Remote Computers
    - Contractor Recommended System Change From Geomation To Campbell
  - In-Place Inclinometers
    - Thermal Drift

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Remediation Attempts

- Instrumentation Summit #2 (Nov 2004)
  - Remote Computers
    - Replace All Remaining Original Boards
    - Upgrade Charging System
    - Reprogram Recanvassing Frequency
    - Possible Signal Interference
  - In-Place Inclinometers
    - Thermal Drift
      - Install IPIs With Automatic Compensation
      - Develop Programming Compensation For IPIs Currently Installed Without Compensation Capability
  - Install Load Cells On All New Anchors

Remediation Attempts

- Geomation 2380MCU Performance History Review / Research (March 2005)
  - CELRH Conducted Performance Evaluation of 2380MCU To Determine If Unit Has Been Utilized With Success In Similar Applications.
  - Review Included Published Reports And Papers, Discussions With System Integrators And Actual End Users.
  - Review Answered Reliability Issue In The Affirmative

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Remediation Attempts

- Instrumentation Summit #3 (April 2005)
  - Reprogram Recanvassing Frequency
    - Increase Time Of Alarm Confirmation Readings
    - Alarms Now Triggered By Two Consecutive Readings That Exceed Threshold Limits As Opposed To One
  - Install Older Version Of Firmware On Specific MCUs
  - MCU Isolation Tests
    - From Radio (Airborne Transients)
    - From Cabled Instruments (Subsurface Transients)
  - Tilt Meters
    - Excitation Voltage No Longer Provided By MCU

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Remediation Attempts

- Instrumentation Summit #3 (April 2005) – Cont.
  - In-Place Inclinometers
    - Recalibrate Thermal Compensation
    - Excitation Voltage No Longer Provided By MCU
  - Campbell System Test Installation
  - Website
    - Update To Include All System Modifications
    - Address Issue Of Lost Data Transmission

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Remediation Attempts

- TCX - APMD
  - Technical Center of Expertise (TCX) for Automated Performance Monitoring of Dams (CEMVS) has been contracted to perform an independent evaluation of the Marmet ADAS through a contract with URS

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Current Status of ADAS

- Reliability Of Data Still Suspect
  - Contractor has been able to reduce the number of false alarms but the reliability of data being produced is still suspect.
- TCX – APMD / URS
  - On Site System Review Week Of 15 August

Jeff Rakes
304-399-5809

Ron Adams, P.G.
304-949-1934

BEARS

Questions ?

US Army Corps of Engineers
Louisville District

Mississinewa Dam Foundation Rehabilitation

Jeff Schaefer

Geotechnical Regional Technical Specialist

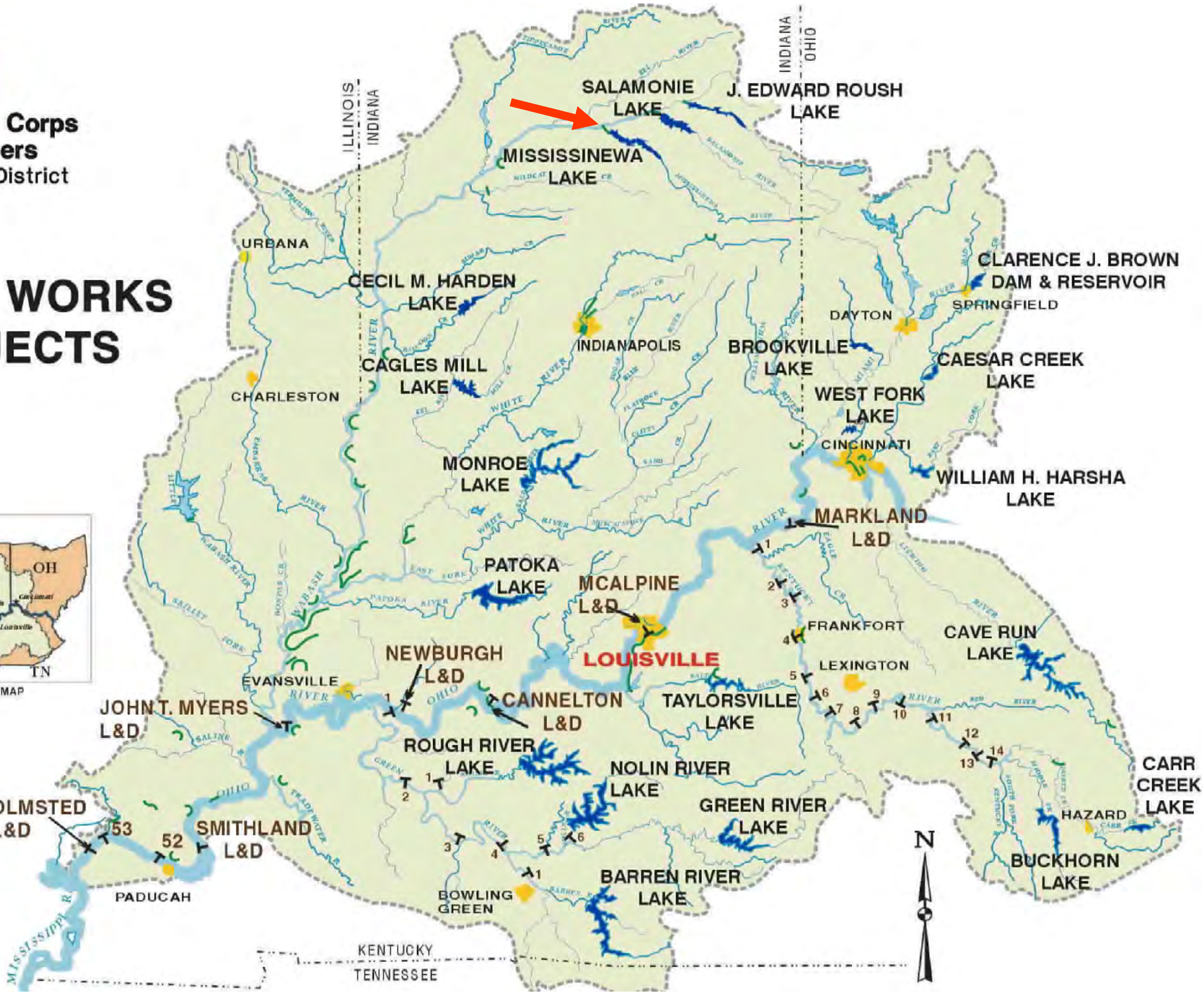
U.S. Army Corps of Engineers

Louisville District

US Army Corps of Engineers
Louisville District

CIVIL WORKS PROJECTS

VICINITY MAP

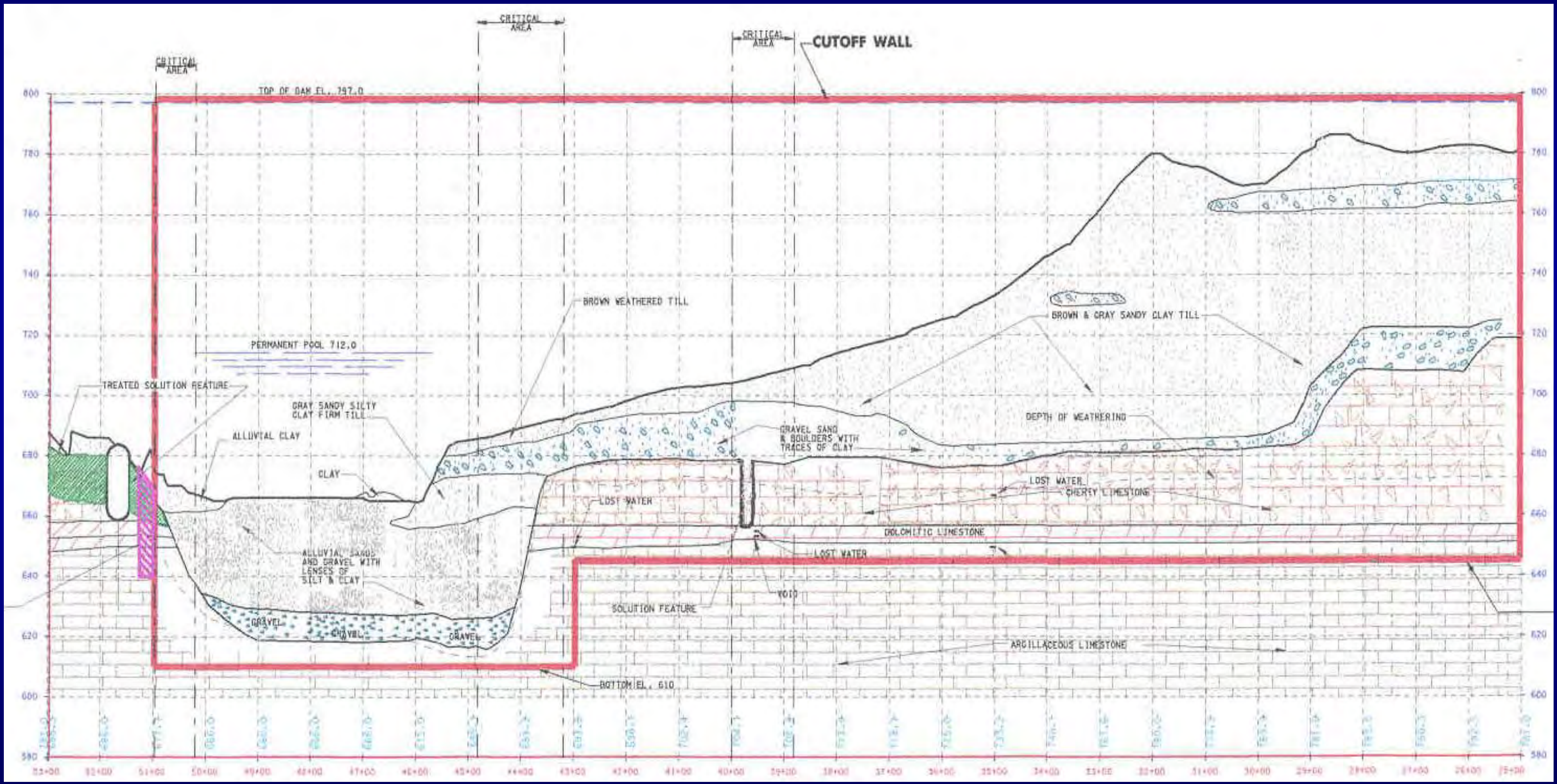


Constructed – Mid to Late 1960's

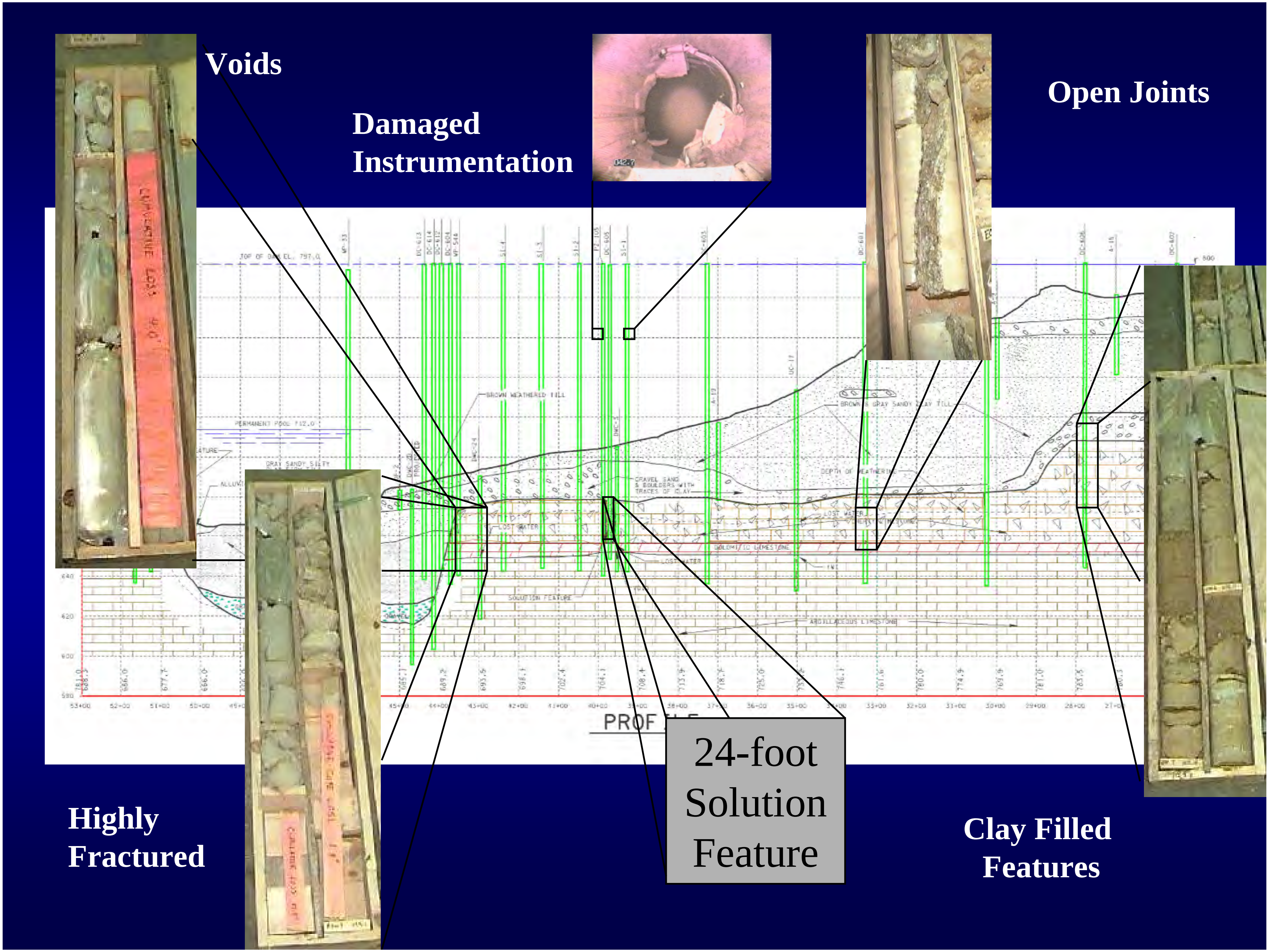
• Total length	8100 feet
• Total height	140 feet
Crest elevation	797
• Spillway elevation	779
• Summer Pool	737 *
• Winter Pool	712

Geology

Glacial Deposits:	10-70 feet	Silty clay overlying sands and gravels
Liston Creek Fm:	0-70 feet	Thinly bedded, cherty, crystalline limestone prone to solutioning.
Mississinewa Fm:	> 30 feet	Thinly bedded argillaceous limestone



Typical geologic cross-section along the dam centerline.


Voids
Damaged Instrumentation
Open Joints
Highly Fractured
24-foot Solution Feature
Clay Filled Features

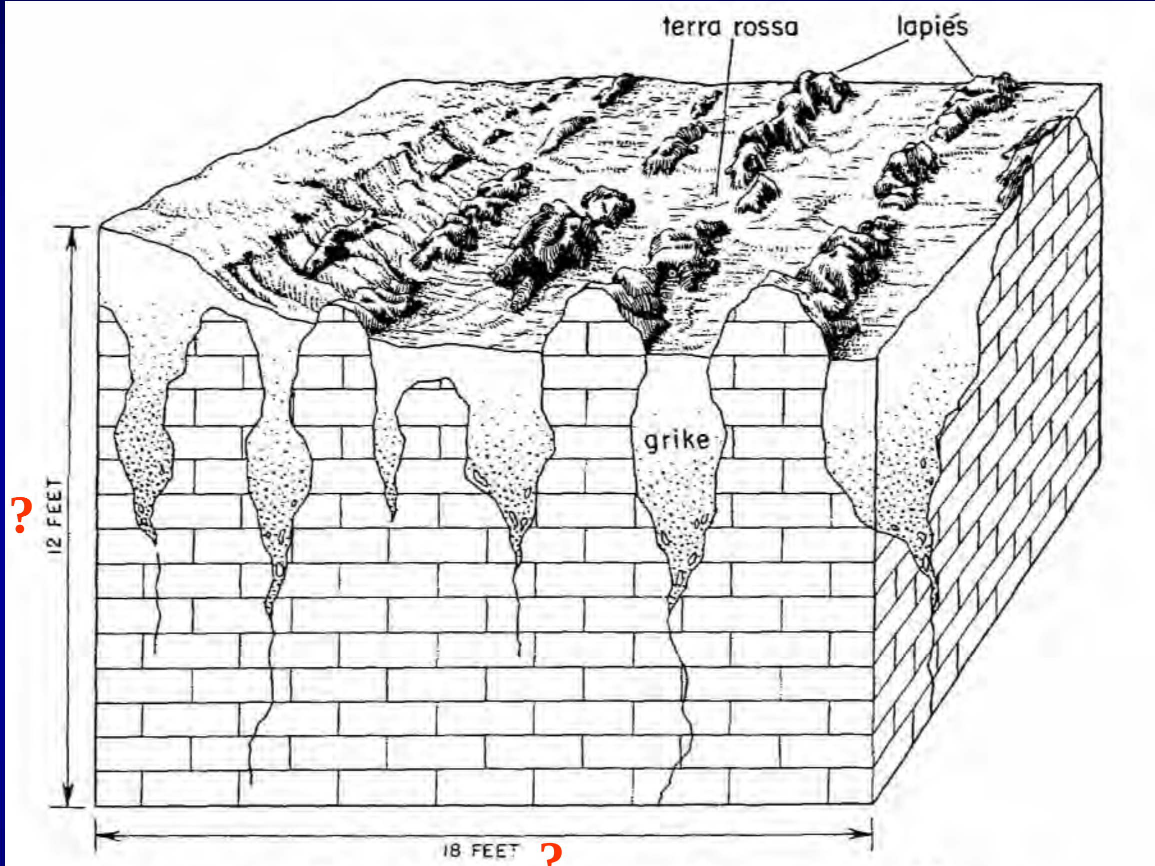


Figure 3.--Block diagram showing the structure of lapies and grikes.

Adapted From Indiana Geological Survey,
Caves of Indiana by Richard L. Powell

Solution feature on left abutment side of conduit excavation

View of solution channel, located at dam station 51+00, on left abutment side of conduit excavation.

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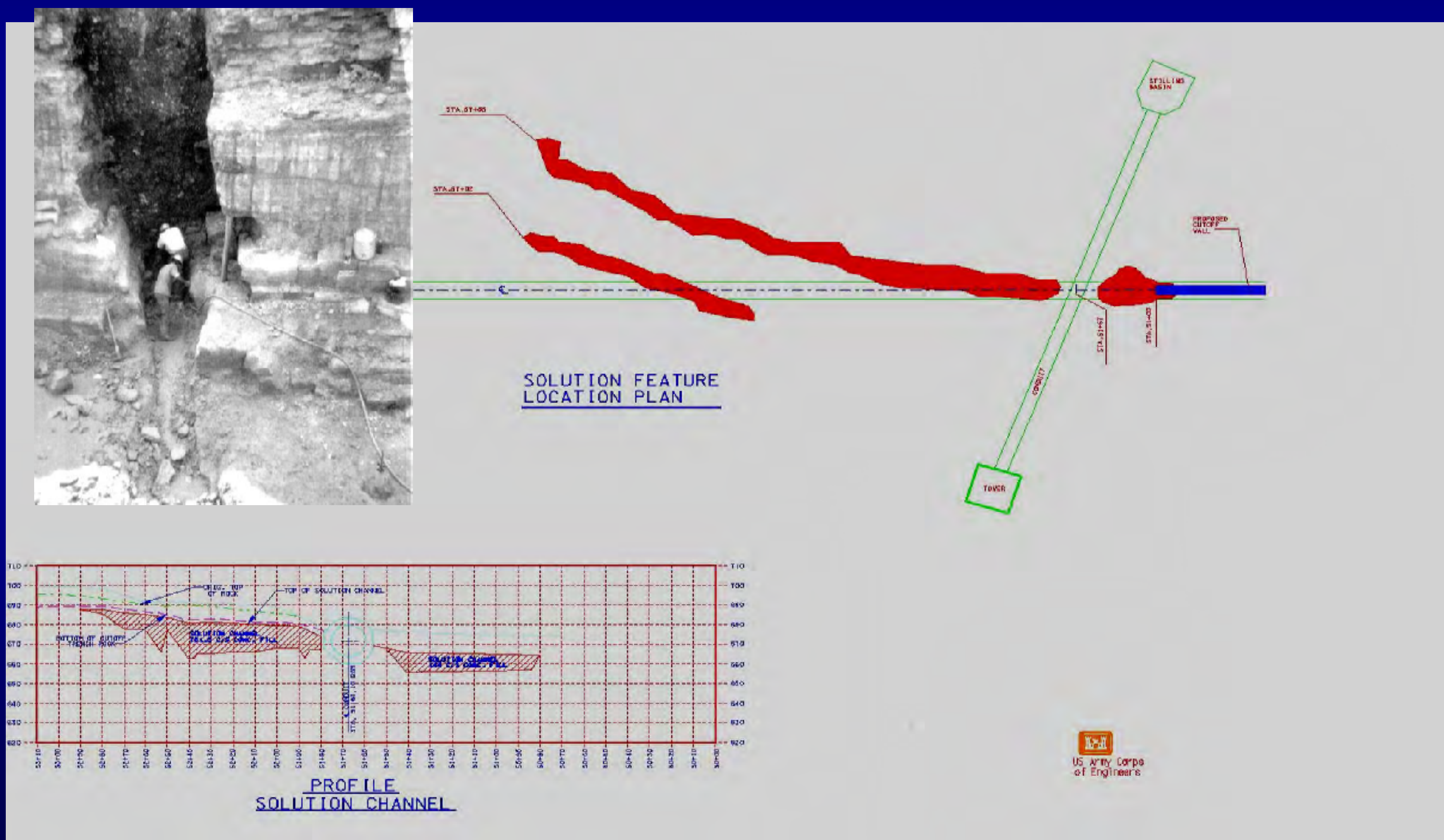
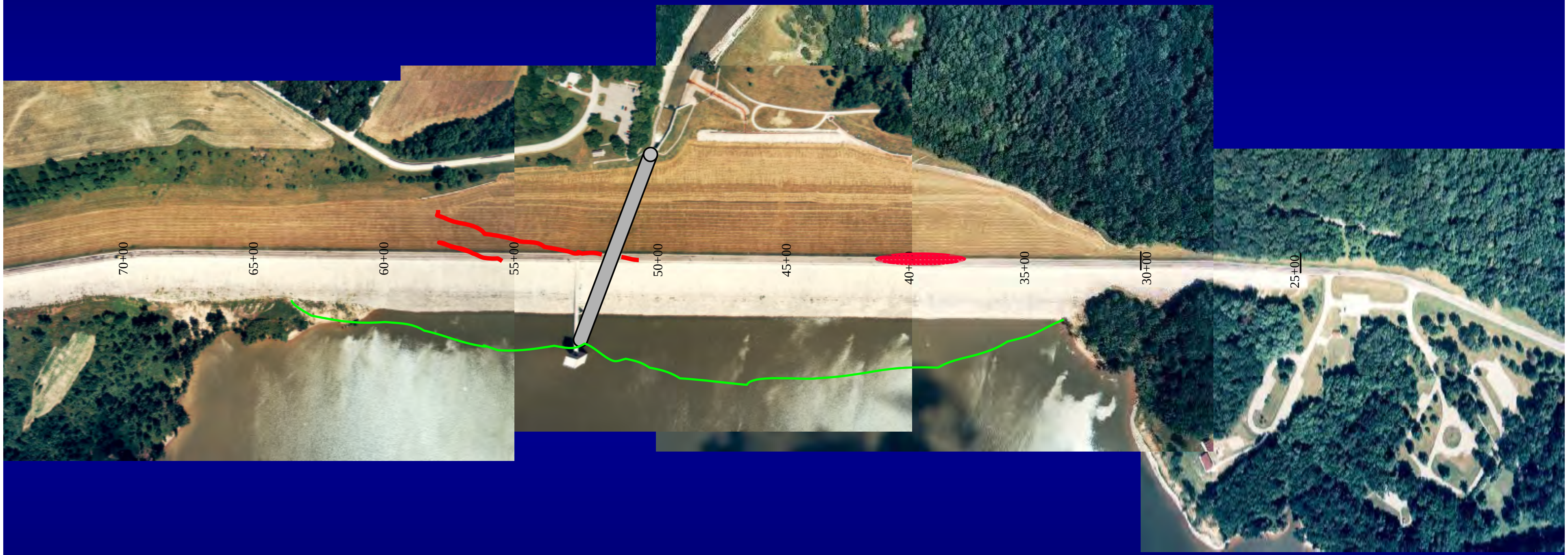
Louisville District

Geotechnical and Dam Safety Section
MISSISSINEWA DAM

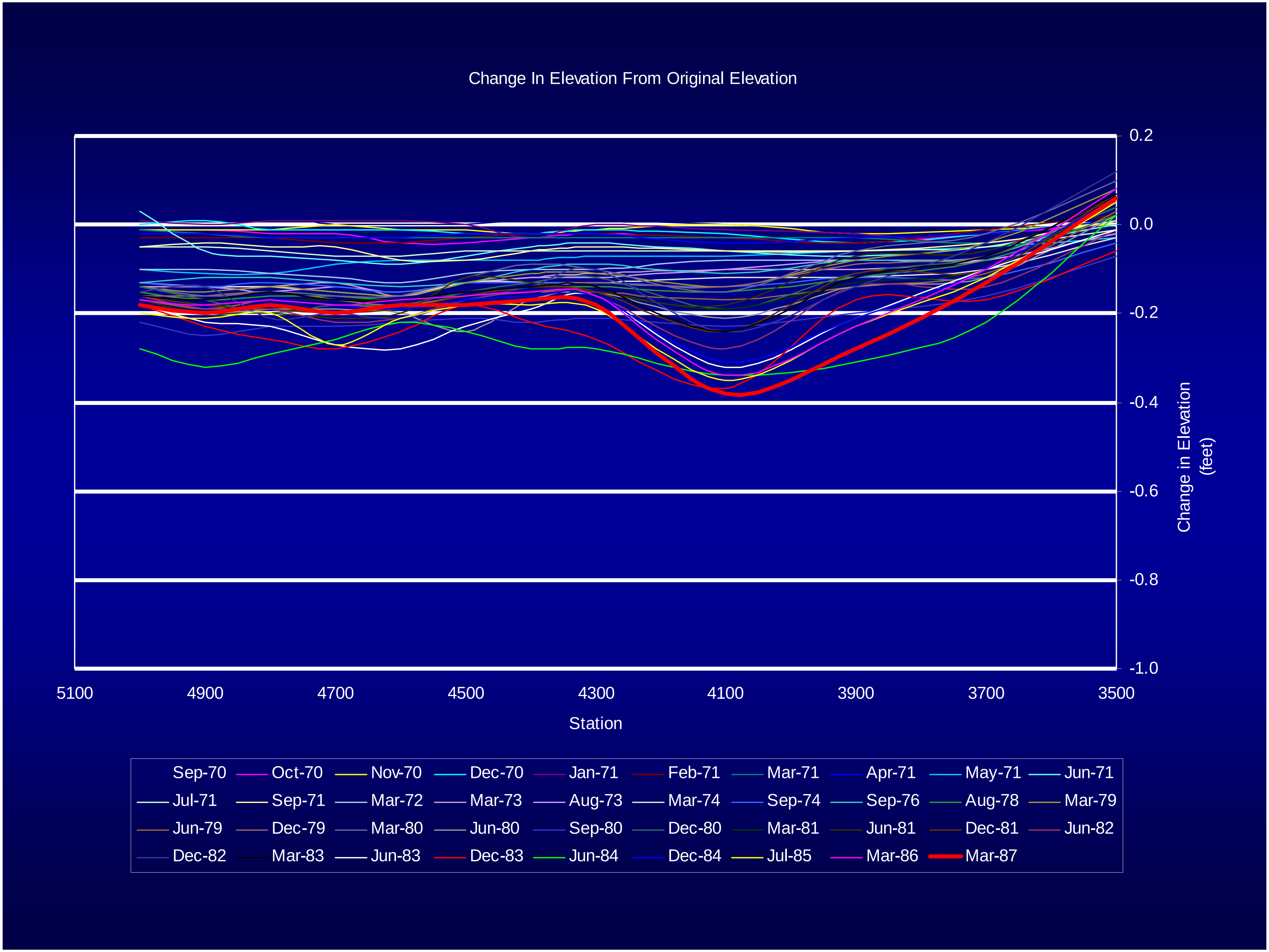


Features of Interest for the Mississinewa Dam Project

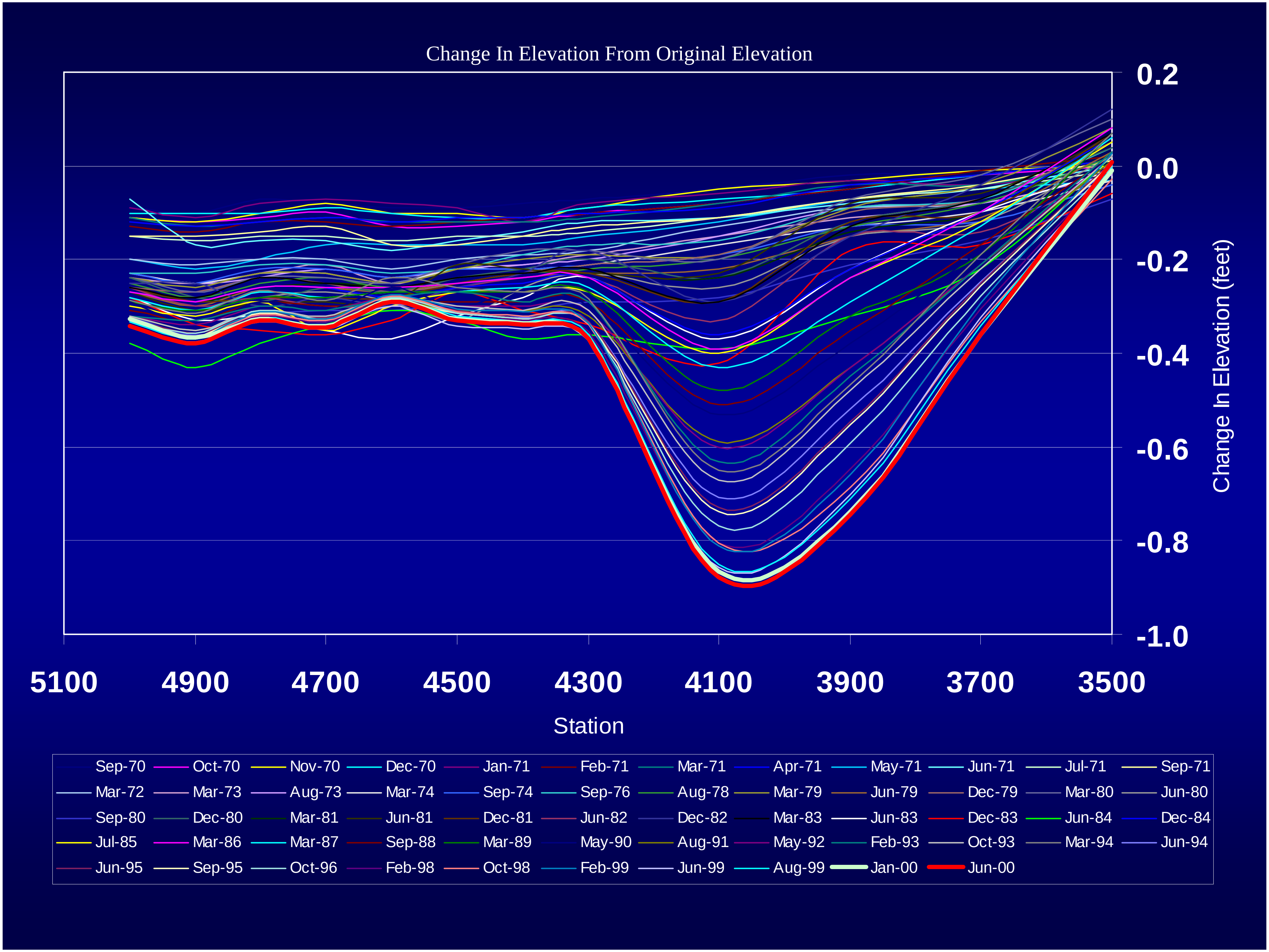


1988

Operations Personnel Identify Guardrail Deflections

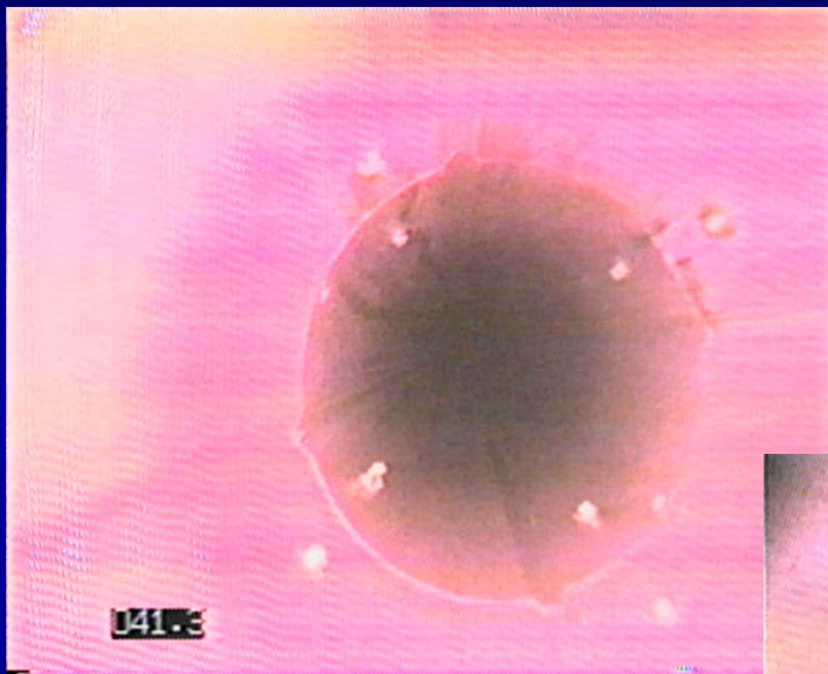


Change In Elevation From Original Elevation
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
Change in Elevation (feet)
5100
4900
4700
4500
4300
4100
3900
3700
3500
Station
Sep-70
Oct-70
Nov-70
Dec-70
Jan-71
Feb-71
Mar-71
Apr-71
May-71
Jun-71
Jul-71
Sep-71
Mar-72
Mar-73
Aug-73
Mar-74
Sep-74
Sep-76
Aug-78
Mar-79
Jun-79
Dec-79
Mar-80
Jun-80
Sep-80
Dec-80
Mar-81
Jun-81
Dec-81
Jun-82
Dec-82
Mar-83
Jun-83
Dec-83
Jun-84
Dec-84
Jul-85
Mar-86
Mar-87

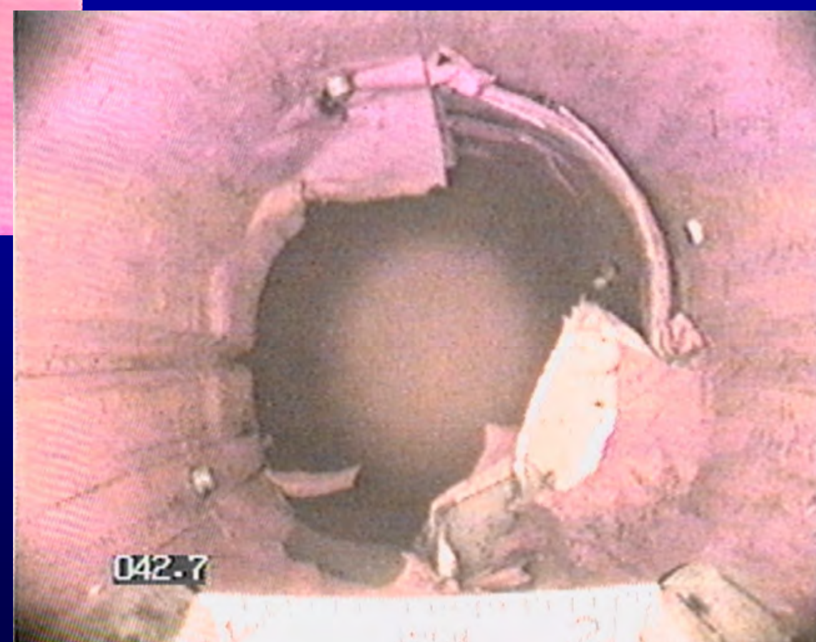


Change In Elevation From Original Elevation
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
Change In Elevation (feet)
5100
4900
4700
4500
4300
4100
3900
3700
3500
Station
Sep-70 Oct-70 Nov-70 Dec-70 Jan-71 Feb-71 Mar-71 Apr-71 May-71 Jun-71 Jul-71 Sep-71
Mar-72 Mar-73 Aug-73 Mar-74 Sep-74 Sep-76 Aug-78 Mar-79 Jun-79 Dec-79 Mar-80 Jun-80
Sep-80 Dec-80 Mar-81 Jun-81 Dec-81 Jun-82 Dec-82 Mar-83 Jun-83 Dec-83 Jun-84 Dec-84
Jul-85 Mar-86 Mar-87 Sep-88 Mar-89 May-90 Aug-91 May-92 Feb-93 Oct-93 Mar-94 Jun-94
Jun-95 Sep-95 Oct-96 Feb-98 Oct-98 Feb-99 Jun-99 Aug-99 Jan-00 Jun-00

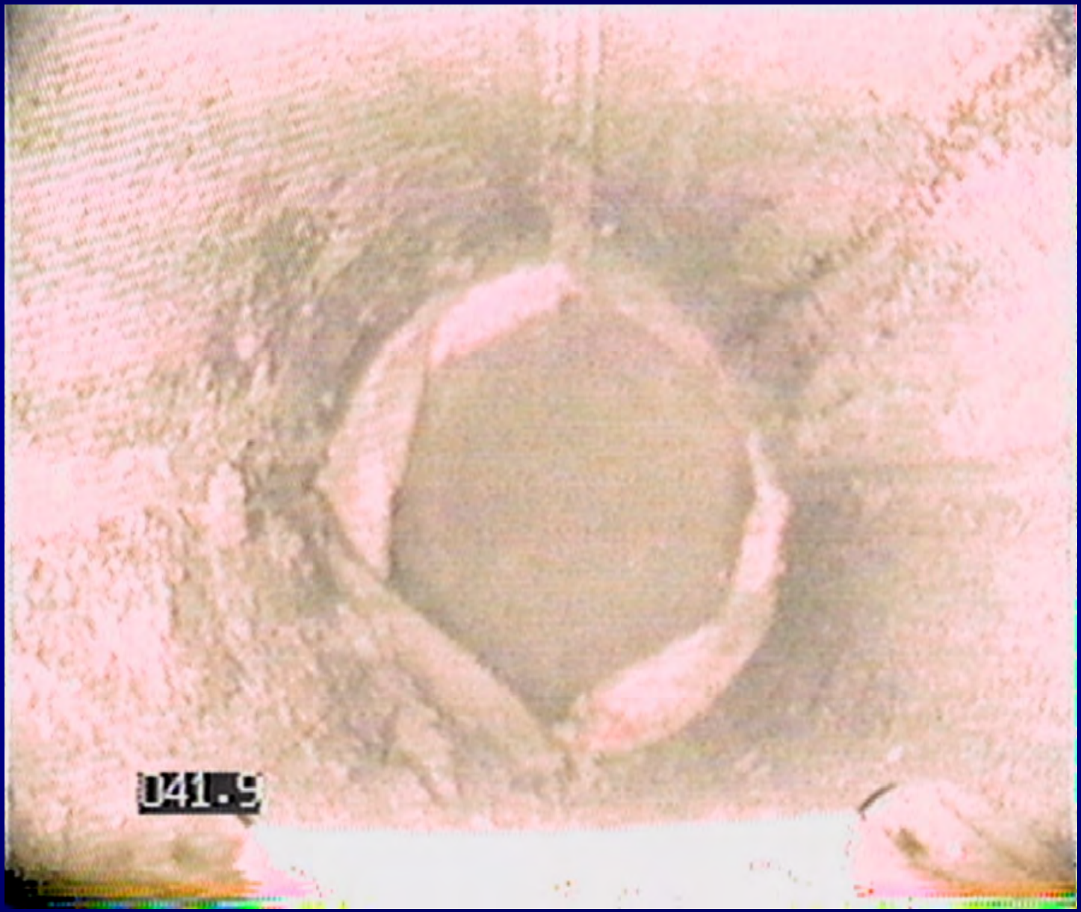
SI-1 (station 40+25), approximately elevation 758



View in May 1995

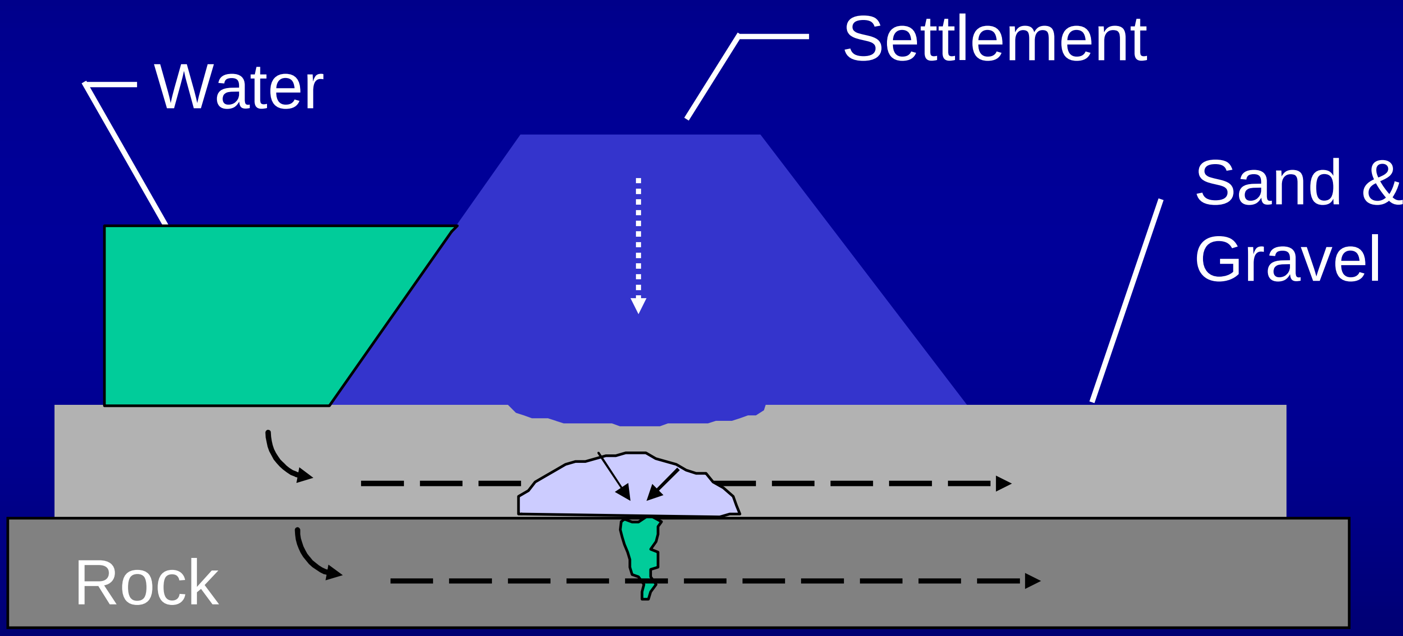


View in June 1999



June 1999 view of SI-2 (station 40+25)
at approximately elevation 758

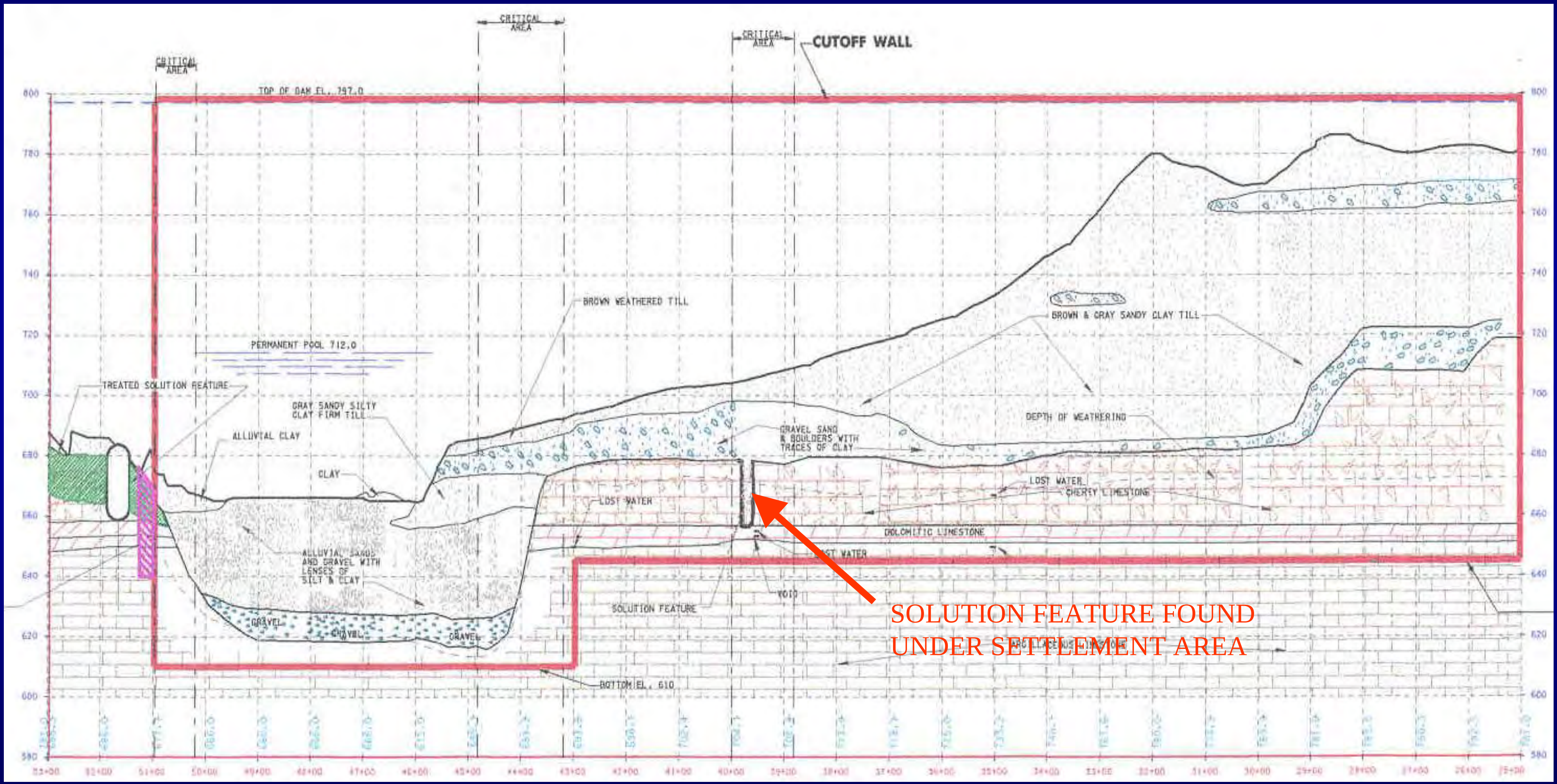
Settlement Mechanism
Foundation Piping



Not To Scale

Cut-off Wall

A cut-off wall was selected as the only practical and certain method of repairing the foundation for the dam. The cutoff wall would extend to depths of 180 feet and up to 80' into rock.



Typical geologic cross-section along the dam centerline.

Construction Contract

RFP Performance Specification

Requirements Specified & Methods Restricted

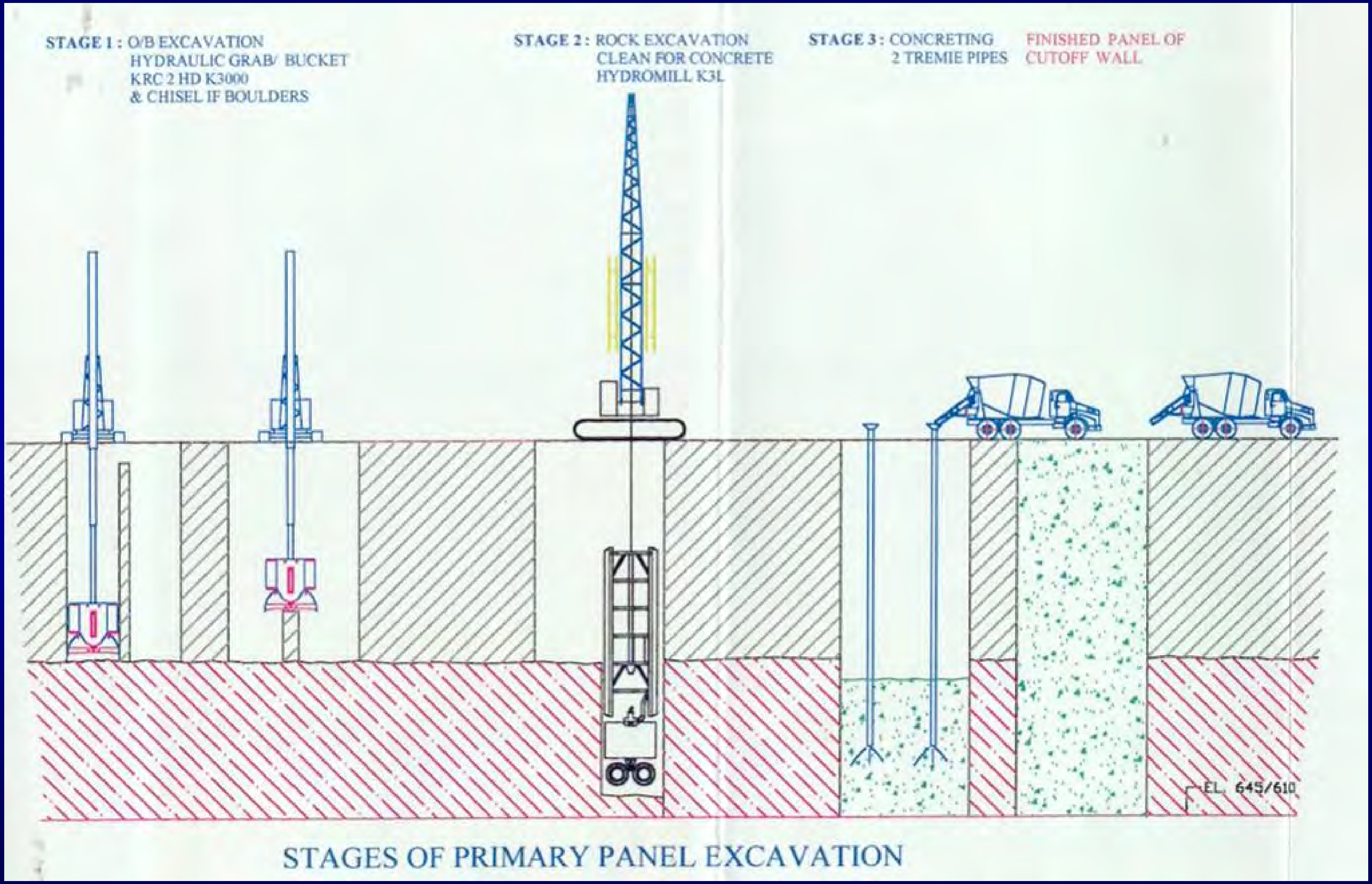
Methods Selected by Contractor

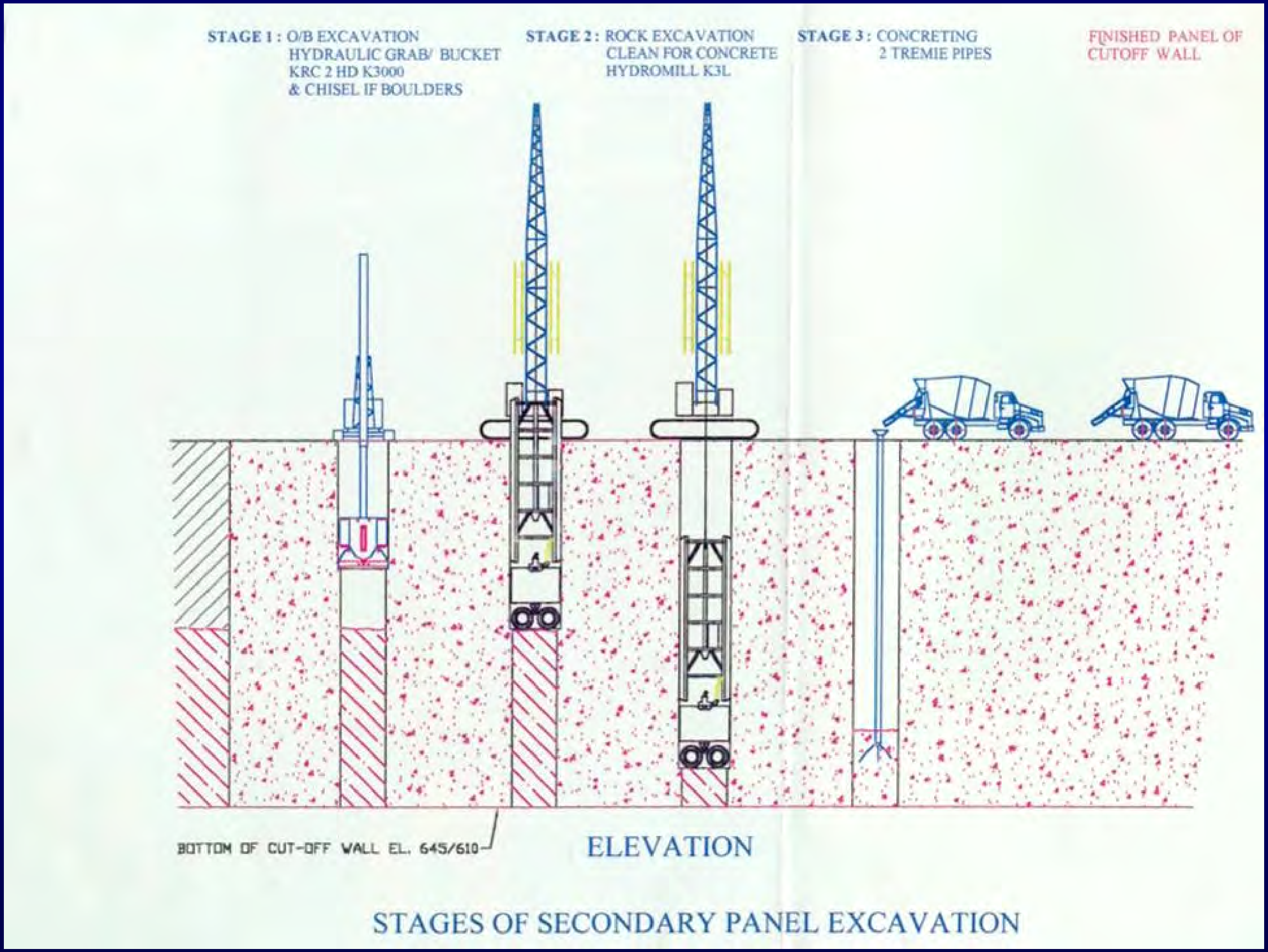
Technical Factors More Important Than Price

Contract Award

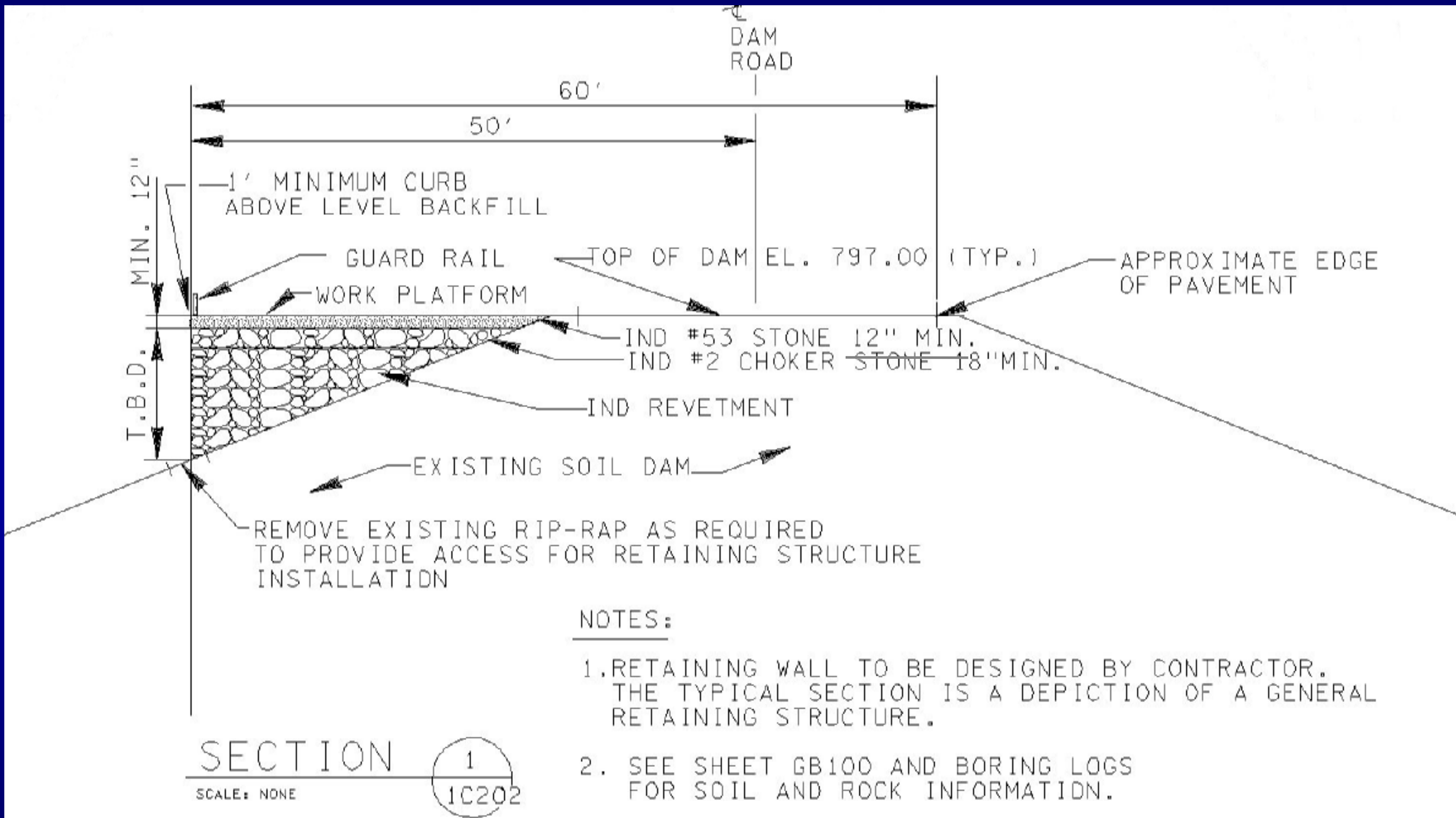
All 3 Proposed Clamshell/ Hydrofraise Backup Method – Chisel Supplement

Award to Bencor/Petrifond JV for $29,800,000 September 2000


STAGE 1 : O/B EXCAVATION
HYDRAULIC GRAB/ BUCKET
KRC 2 HD K3000
& CHISEL IF BOULDERS
STAGE 2 : ROCK EXCAVATION
CLEAN FOR CONCRETE
HYDROMILL K3L
STAGE 3 : CONCRETING
2 TREMIE PIPES
FINISHED PANEL OF
CUTOFF WALL
EL. 645/610
STAGES OF PRIMARY PANEL EXCAVATION


STAGE 1 : O/B EXCAVATION
HYDRAULIC GRAB/ BUCKET
KRC 2 HD K3000
& CHISEL IF BOULDERS
STAGE 2 : ROCK EXCAVATION
CLEAN FOR CONCRETE
HYDROMILL K3L
STAGE 3 : CONCRETING
2 TREMIE PIPES
FINISHED PANEL OF
CUTOFF WALL
BOTTOM OF CUT-OFF WALL EL. 645/610
ELEVATION
STAGES OF SECONDARY PANEL EXCAVATION

Site Map Showing Major Areas of Interest



NOTES:

1. RETAINING WALL TO BE DESIGNED BY CONTRACTOR. THE TYPICAL SECTION IS A DEPICTION OF A GENERAL RETAINING STRUCTURE.

2. SEE SHEET GB100 AND BORING LOGS FOR SOIL AND ROCK INFORMATION.

3. T.B.D. = TO BE DETERMINED. ACTUAL EMBEDMENT DEPTH SHALL BE DETERMINED BY THE CONTRACTOR.

4. EMBEDMENT DEPTHS FOR WORK PLATFORM WINGS SHALL BE SUFFICIENT TO RETAIN STONE BACKFILL. IN NO CASE SHALL EMBEDMENT BE LESS THAN 5'-0".

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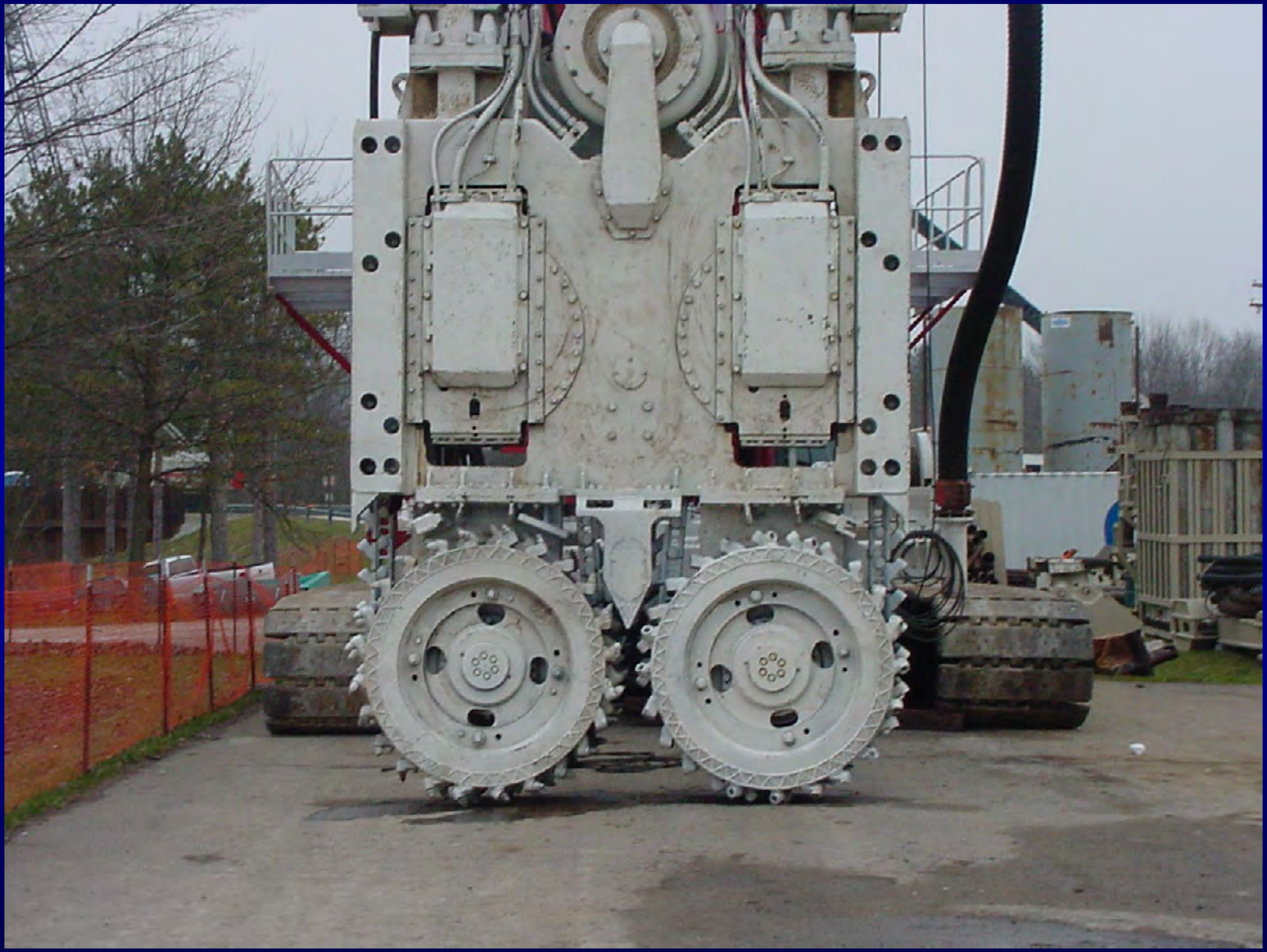
Cable-Clam Bucket



Geotechnical and Dam Safety Section
MISSISSINEWA DAM

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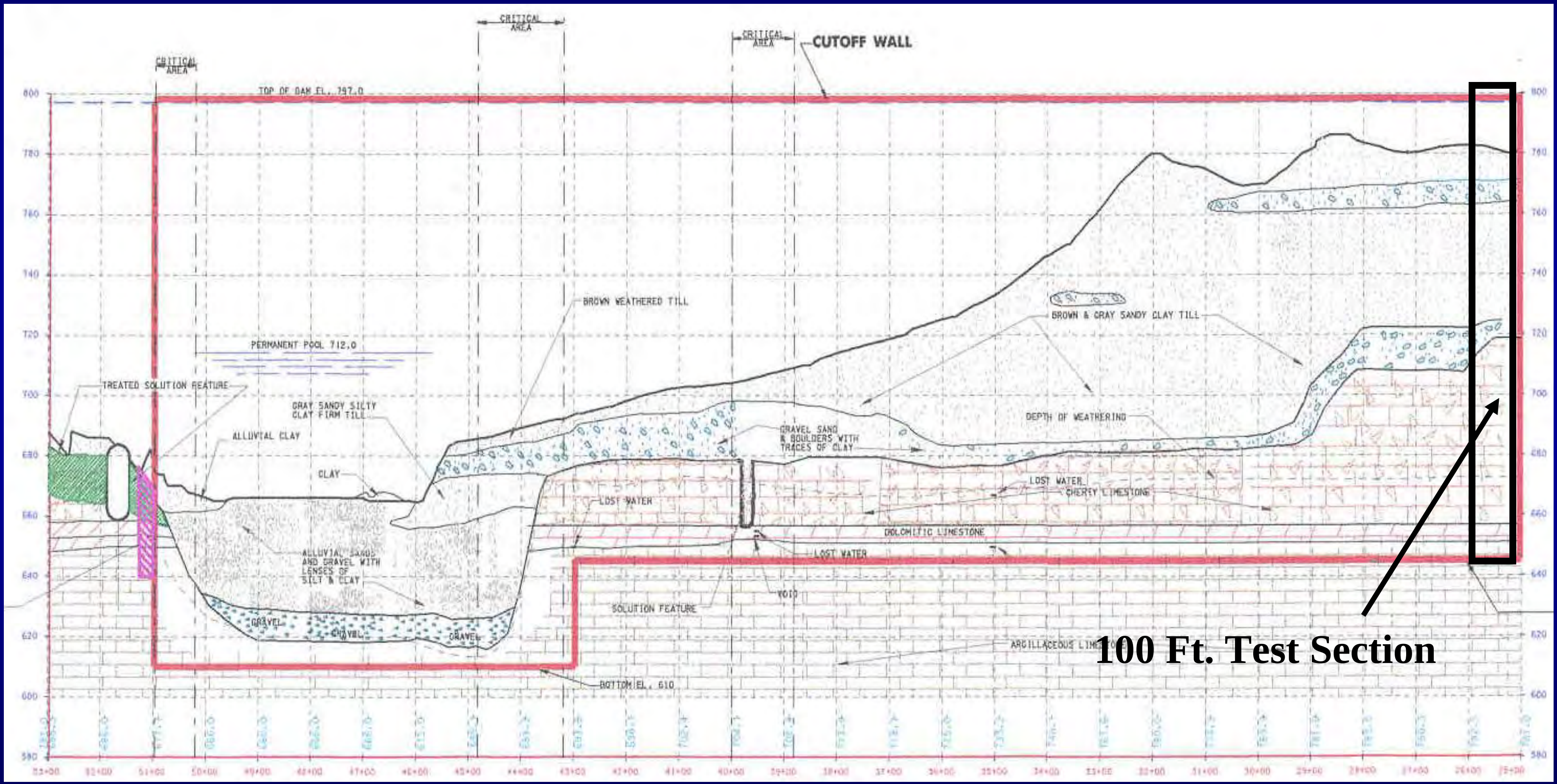
Test Section



Typical geologic cross-section along the dam centerline.

Test Section

Attempts to Excavate Rock in Test Section Resulted in Sudden Complete Slurry Loss

Test Section

Change To Construction Approach

Pregrouting Required to Enable Cutoff Wall Construction

RFP type selection of the Grouting Subcontractor (ACT)

Grouting ITR by Dr. Donald Bruce

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Rotosonic Drill Rig

Sample Extrusion

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Rotosonic Samples

Rock Drill

Two High Speed/High Volume Grout Plants

Grout Header Controls

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IntelliGrout

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IntelliGrout Operator’s Station

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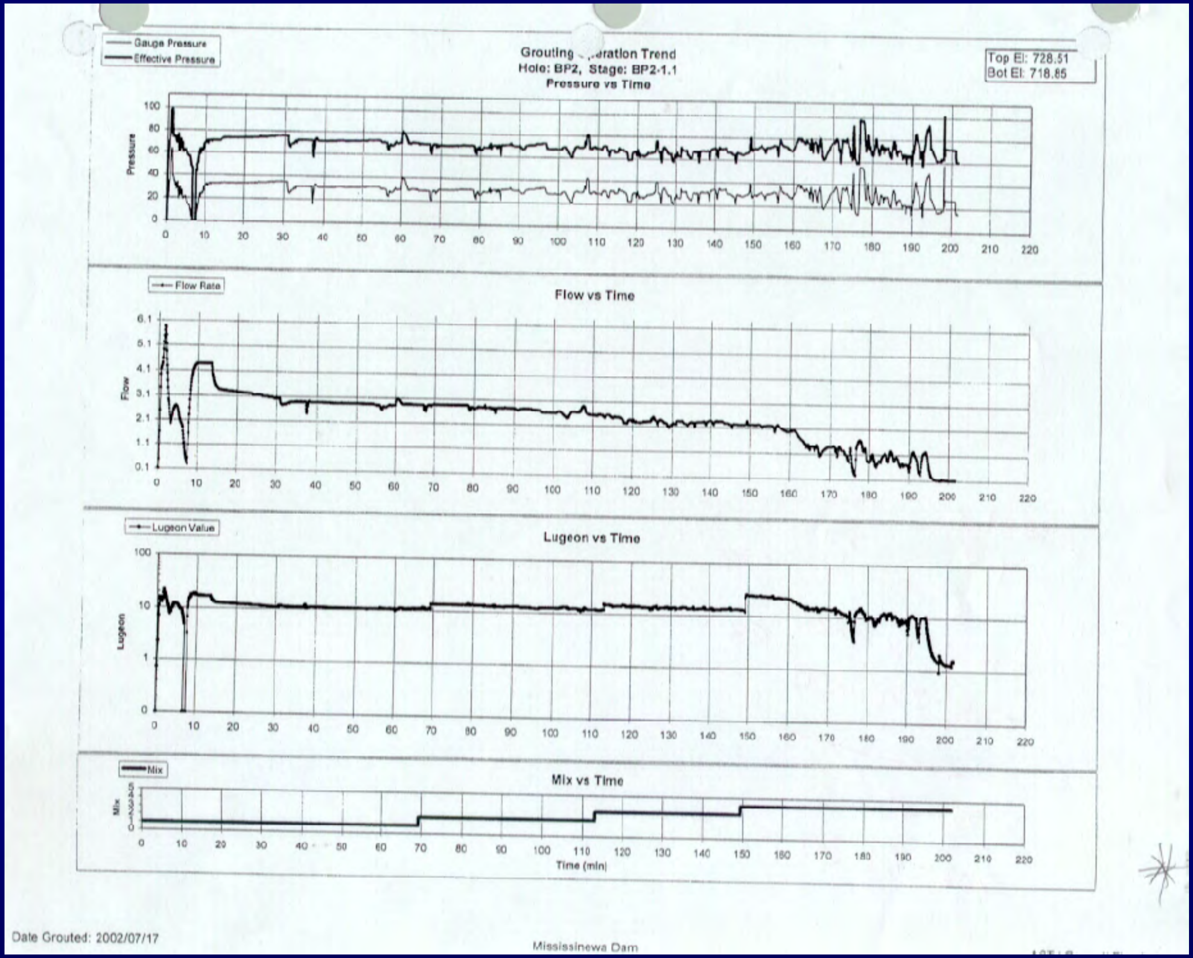
Geotechnical and Dam Safety Section
MISSISSINEWA DAM



Typical Void Refusal, Refined "D Mix"

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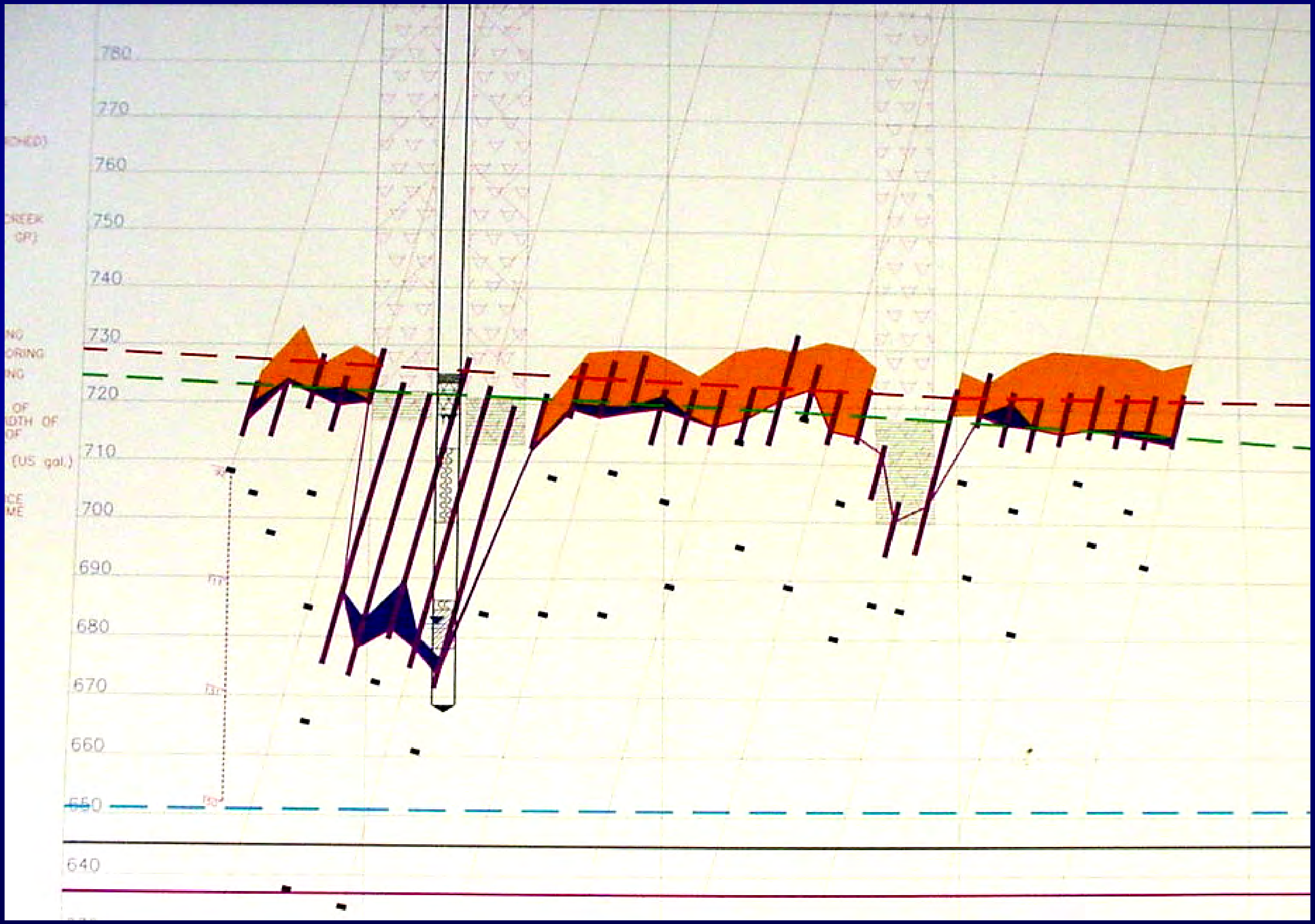
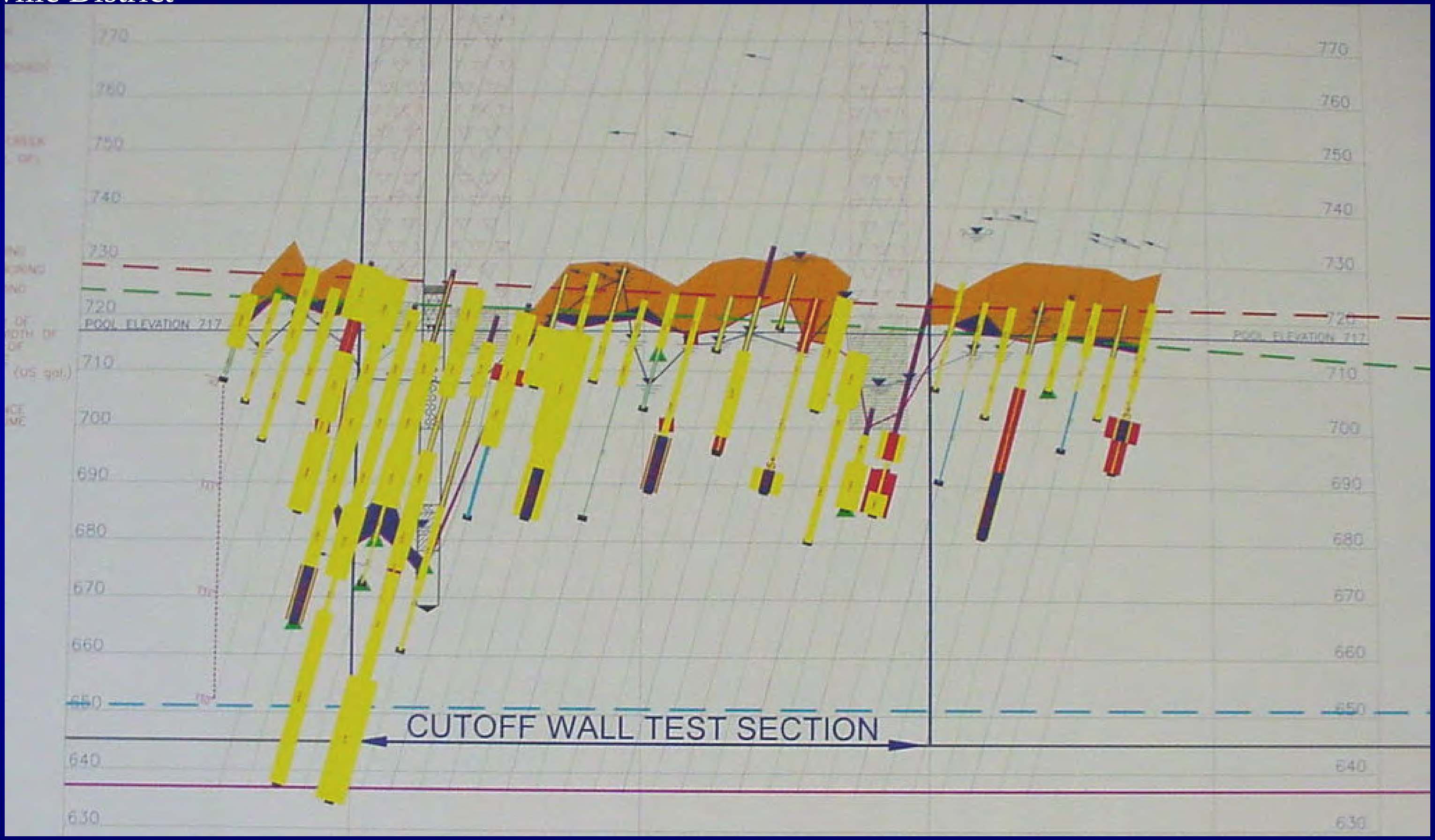
Test Section





B Line Master Drawing

Grout Line Layout

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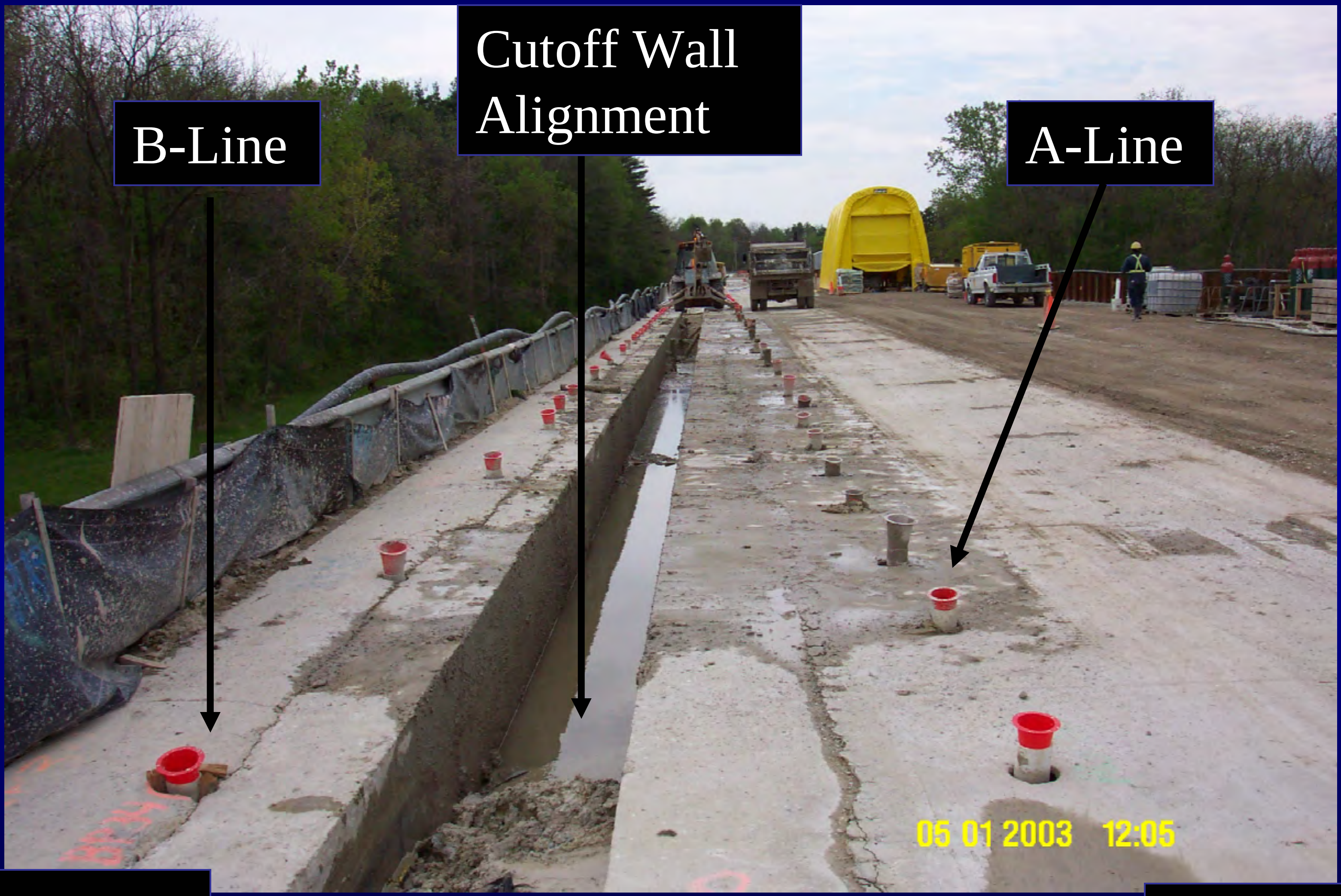

Downstream

Upstream


PETRIFOND

US Army Corps
of Engineers
Louisville District

US Army Corps of Engineers
Louisville District

Geotechnical and Dam Safety Section
MISSISSINEWA DAM

Tremie Concrete Placement

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Louisville District

Test Section

Test section is complete.

Pregrouting was successful. NO SLURRY LOSSES

An optimum program for production was developed.

Drilling for grouting will provide a preview to problems.

Cost growth due to grouting is unknown.

Actual quantities required to treat features will govern.
$10 - 15 Million (Likely)
$25 Million (Worst Case)

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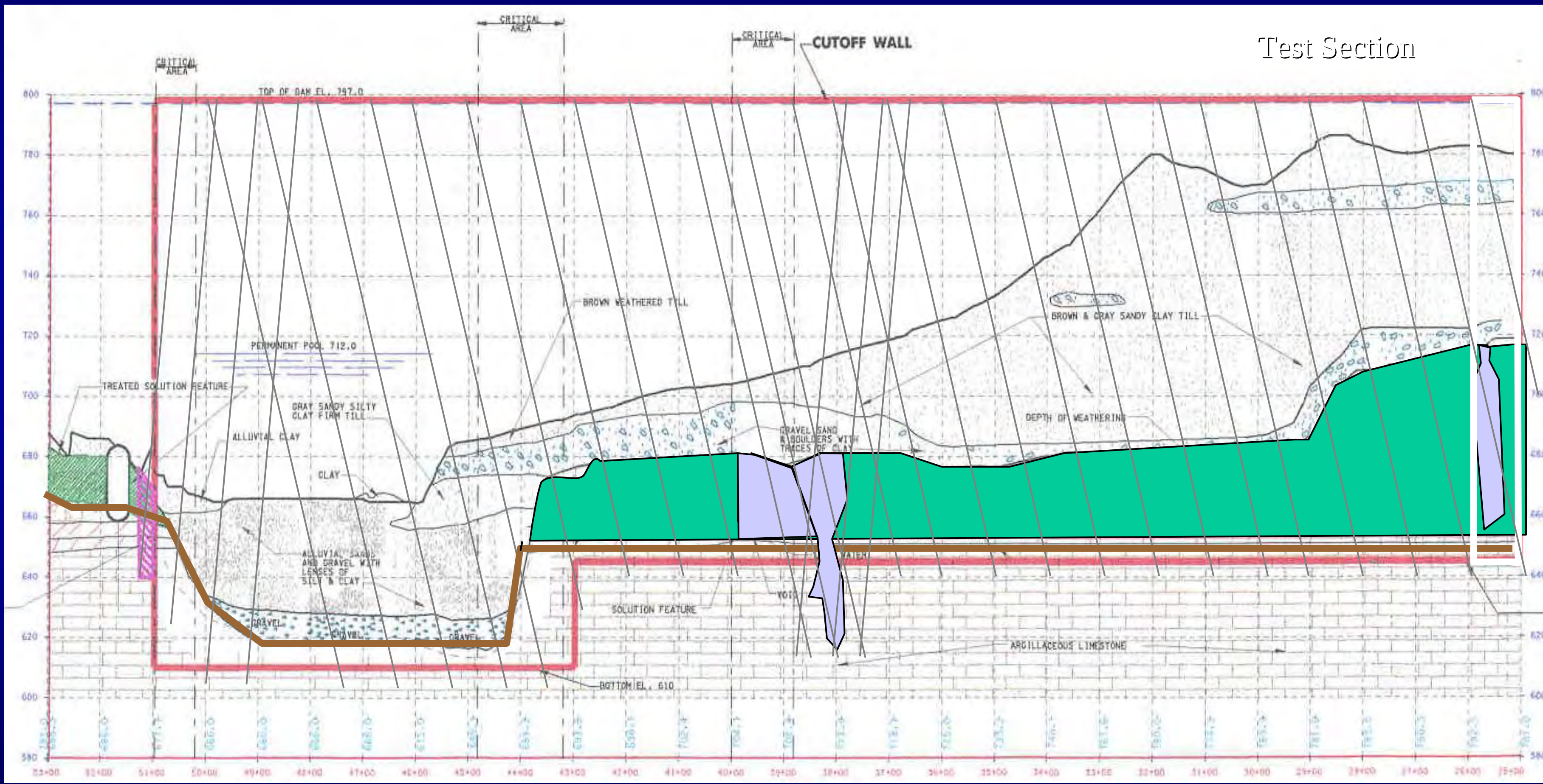
Geotechnical and Dam Safety Section
MISSISSINEWA DAM

Production Grout Hole Alignment



Holes were drilled on both sides of the cutoff wall

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Crane Mod For Deep Section

Bencor-Petrifond, J.V.
BENCOR PETRIFOND

Extended Hydromill
June, 2004
Dam Foundation Remediation
Contract No. DACW27-01-C-0018

U.S. Army Corps of Engineers

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Crane Boom Failure

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Geotechnical and Dam Safety Section
MISSISSINEWA DAM

Crane Fire

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Mill Recovery

Geotechnical and Dam Safety Section
MISSISSINEWA DAM

Bencor-Petrifond, J.V.

Mill Retrieval With Dywidag Bars
September, 2004
Dam Foundation Remediation
Contract No. DACW27-01-C-0018

U.S. Army Corps of Engineers

Mill Recovery

Bencor-Petrifond, J.V.

Mill Retrieval Hydraulic Jacks
September, 2004
Dam Foundation Remediation
Contract No. DACW27-01-C-0018

U.S. Army Corps of Engineers

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Louisville District

Mill Recovery

US Army Corps of Engineers
Louisville District

Mill Recovery

Additional Mills Mobilized

Soil Cutting Wheels

Bencor-Petrifond, J.V.
BENCOR PETRIFOND

Hydromill Soil Wheels
December, 2004
Dam Foundation Remediation
Contract No. DACW27-01-C-0018

U.S. Army Corps of Engineers

US Army Corps of Engineers
Louisville District

Mill Fest

Bencor-Petrifond, J.V.

BENCOR PETRIFOND

Hydromills On Platform
December, 2004
Dam Foundation Remediation
Contract No. DACW27-01-C-0018

U.S. Army Corps of Engineers

Geotechnical and Dam Safety Section
MISSISSINEWA DAM

US Army Corps of Engineers
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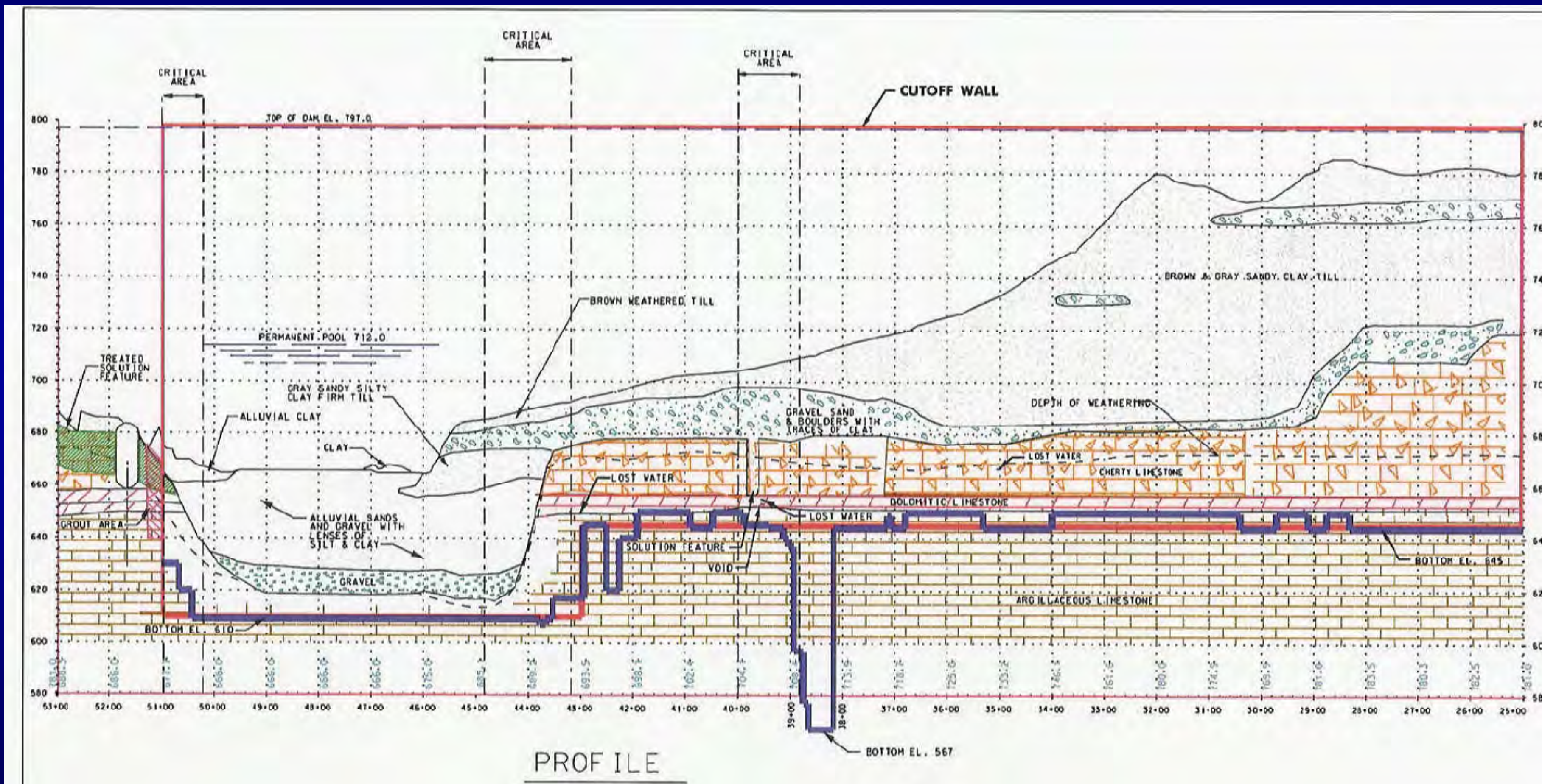
Final Wall Profile



Quality Control

- Bentonite Testing
- Panel Embedment & Continuity
- Panel Verticality
- Concrete Testing
- Verification Drilling
- Dam Instrumentation

Bentonite Testing Equipment

Mud Balance and Marsh Funnel Cone

Pressure Filtration Machine

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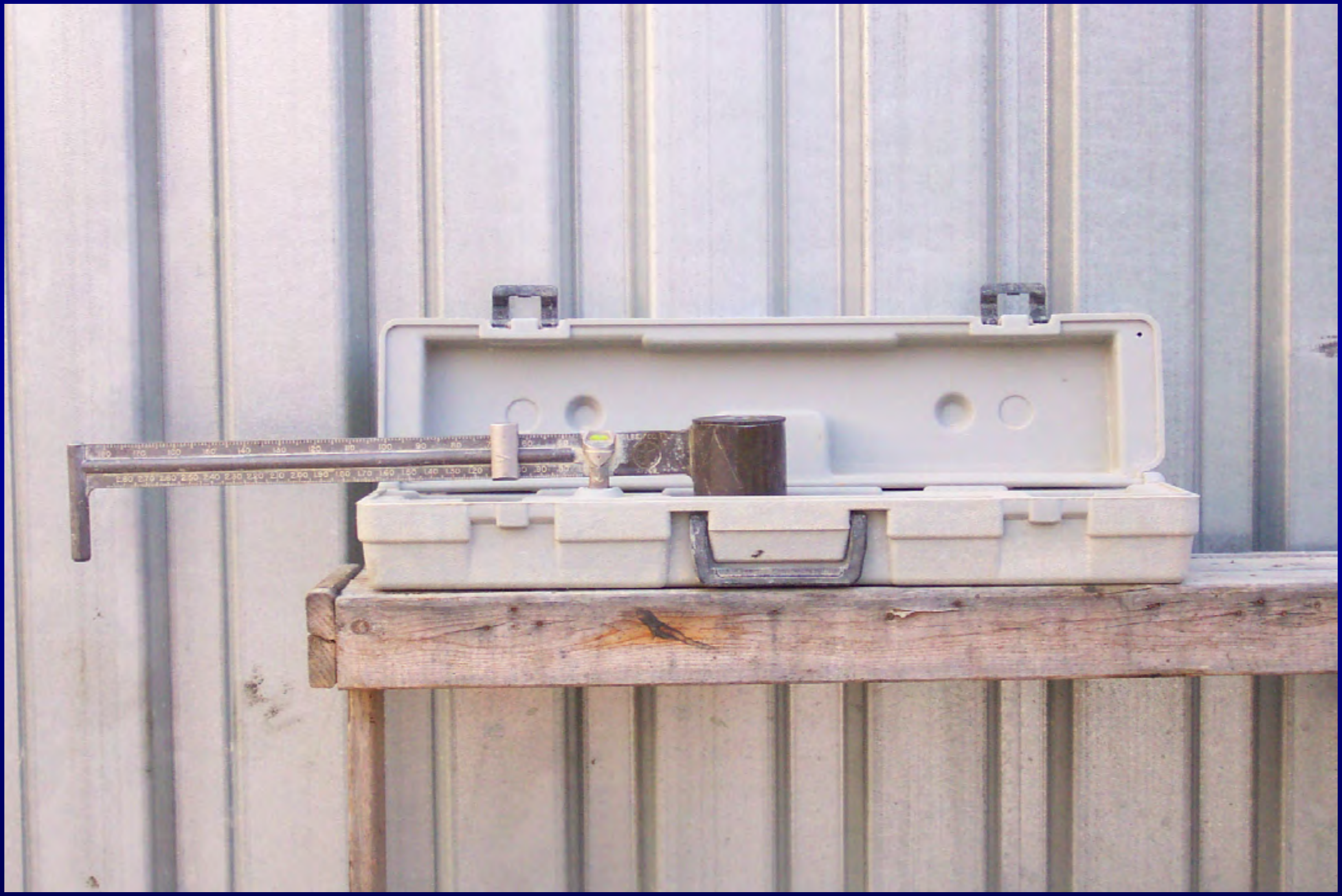
Louisville District

Marsh Funnel Test

US Army Corps
of Engineers
Louisville District

Density Test



Pressure Filtration Testing

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Louisville District

Geotechnical and Dam Safety Section
MISSISSINEWA DAM

Sand Content Testing

Cuttings Observations for Panel Embedment

Verticality Checks

- Hydromill Inclinometer
- Jean Lutz® Inclinometer/Gyroscope
- Plumb Bob
- Koden® 682/684

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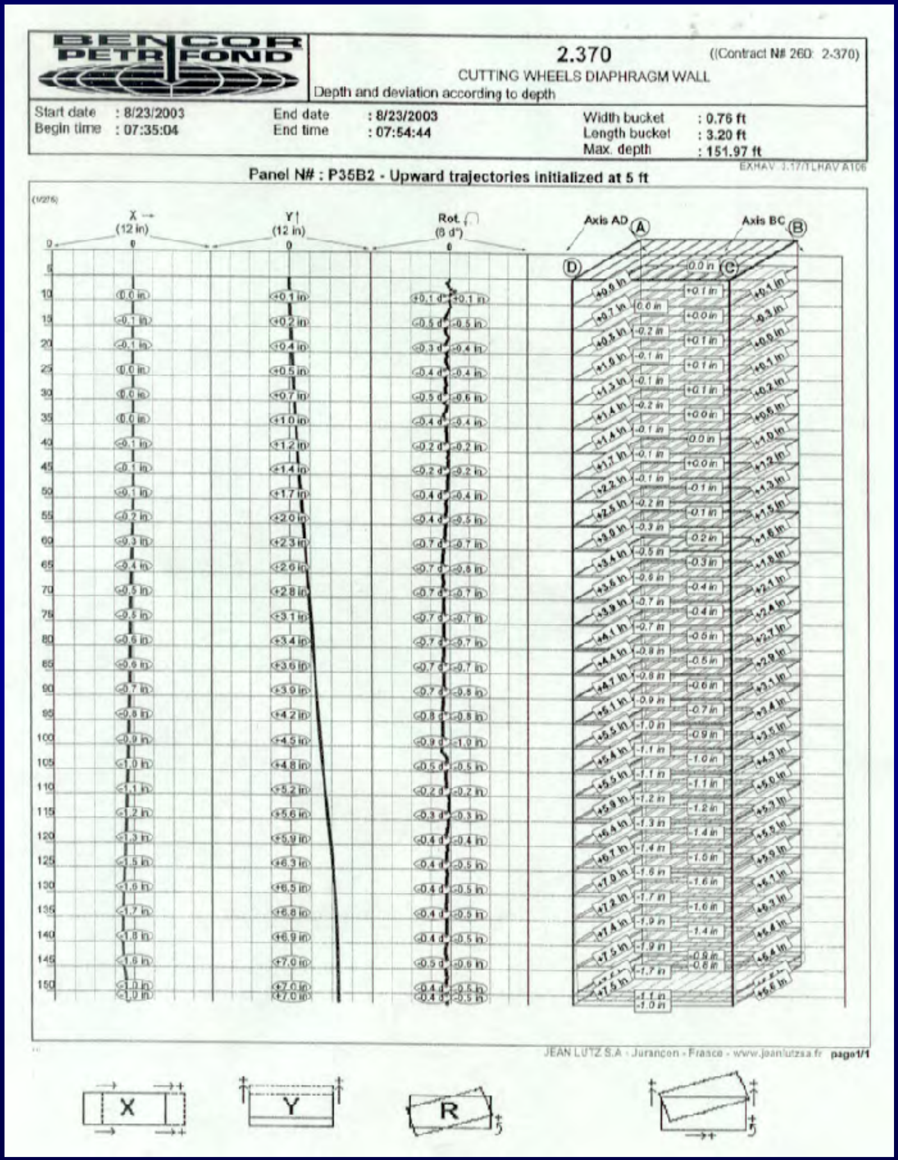
Geotechnical and Dam Safety Section
MISSISSINEWA DAM

Jean Lutz® Plot



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Koden® Verticality Machine

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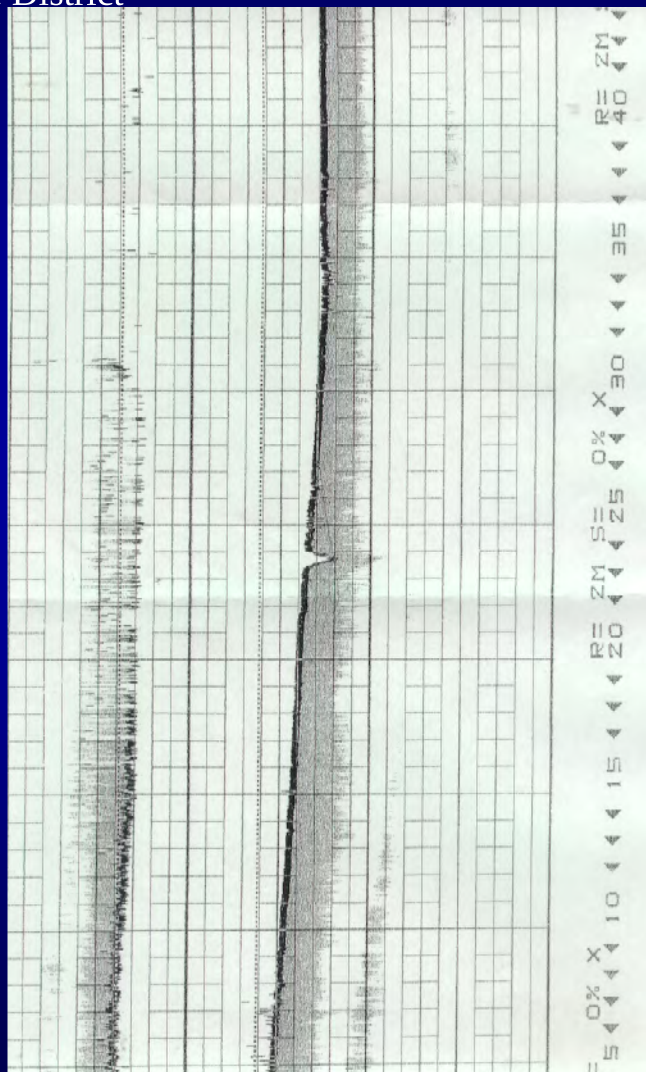
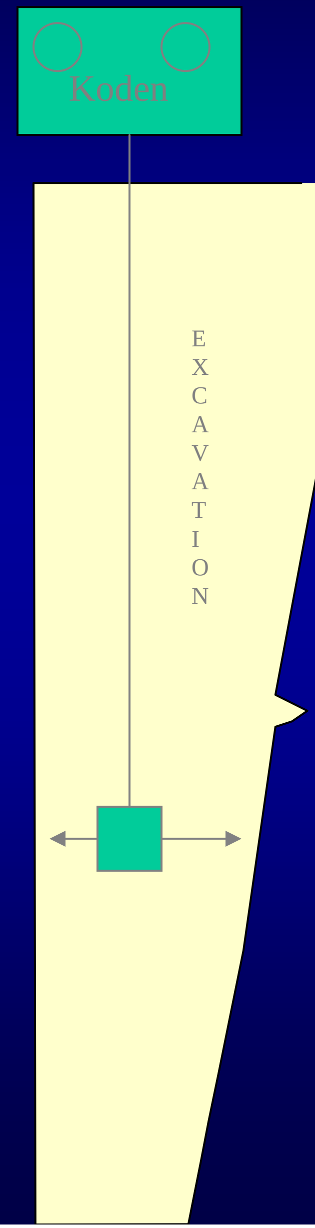
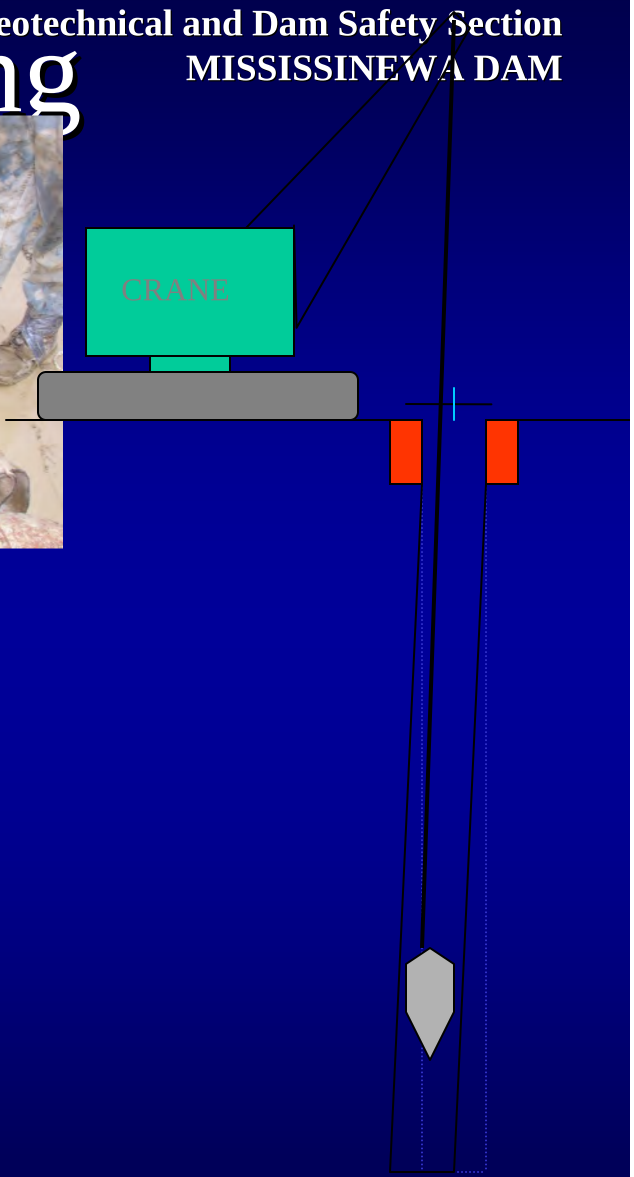
Koden® Plot





US Army Corps

Plumb Bob Reading



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Plumb Bob Results

Bencor-Petrifond, JV 18-Aug-03
Dam Foundation Remediation, Mississinewa Dam

Panel P-11 - Bite #1 - Verticality - Plumb Bob

Height of Boom = 46'	Depth (Ft.) Below Guide Wall	Readings at Guide Wall (Inches)	Panel Deviation (Inches)
	0.00	0.00	0.00
	20.00	0.00	0.00
	30.00	0.13	0.21
	40.00	0.13	0.23
	50.00	0.38	0.78
	60.00	0.38	0.86
	70.00	0.20	0.50
	80.00	0.20	0.55
	90.00	0.63	1.85
	100.00	0.63	1.98
	110.00	1.00	3.39
	120.00	1.00	3.61
	130.00	1.00	3.83
	140.00	1.00	4.04
	150.00	1.13	4.79

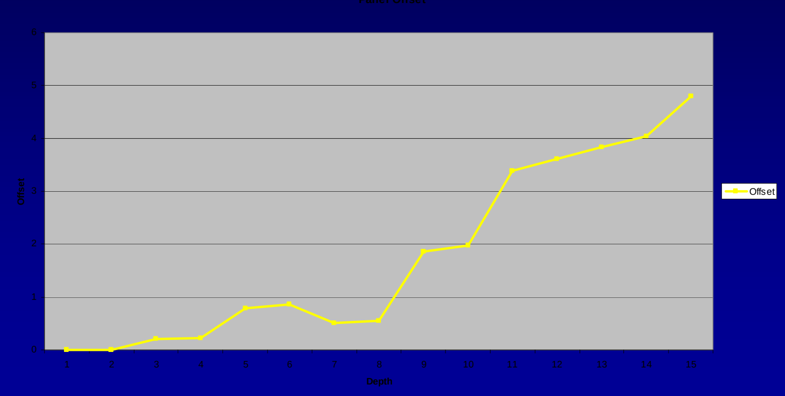
Panel P-11 - Bite #2 - Verticality - Plumb Bob

Height of Boom = 36'	Depth (Ft.) Below Guide Wall	Readings at Guide Wall (Inches)	Panel Deviation (Inches)
	0.00	0.00	0.00
	20.00	0.00	0.00
	30.00	0.25	0.46
	40.00	0.63	1.34
	50.00	1.00	2.43
	60.00	1.25	3.39
	70.00	1.38	4.13
	80.00	1.50	4.93
	90.00	1.63	5.80
	100.00	1.75	6.75
	110.00	2.13	8.80
	120.00	2.50	11.07
	130.00	2.13	10.02
	140.00	2.00	10.00
	150.00	1.50	7.93

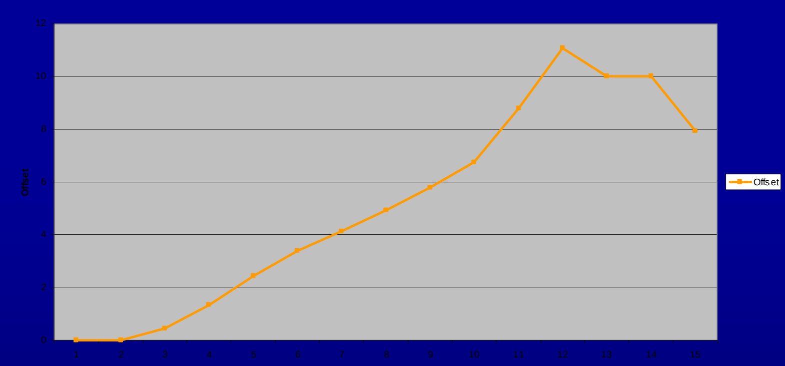
Panel P-11 - Bite #3 - Verticality - Plumb Bob

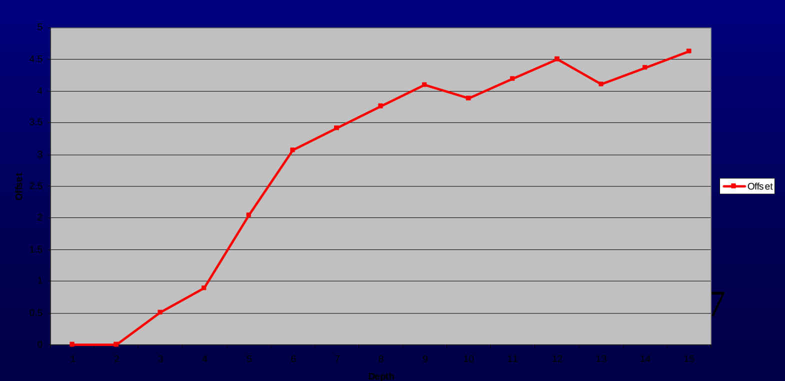
Height of Boom = 29'	Depth (Ft.) Below Guide Wall	Readings at Guide Wall (Inches)	Panel Deviation (Inches)
	0.00	0.00	0.00
	20.00	0.00	0.00
	30.00	0.25	0.51
	40.00	0.38	0.89
	50.00	0.75	2.04
	60.00	1.00	3.07
	70.00	1.00	3.41
	80.00	1.00	3.76
	90.00	1.00	4.10
	100.00	0.88	3.89
	110.00	0.88	4.19
	120.00	0.88	4.50
	130.00	0.75	4.11
	140.00	0.75	4.37
	150.00	0.75	4.63

Note: (-) Upstream, (+) Downstream



Panel Offset



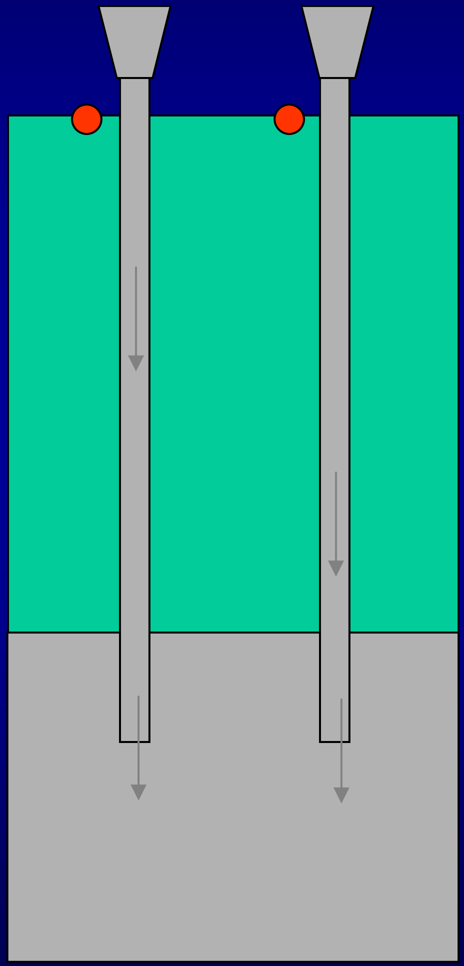


Concrete Quality Checks

- Batch Plant
  - Scale Calibration quarterly
  - Electronic Moisture meter calibration
  - Sieve Analysis on aggregates
  - Gradation analysis on aggregates
  - Moisture on sand and aggregate
  - Fly-ash grain size analysis

Tremie Procedures

- Go-Devil utilized
- Tremie Pipe Embedment
- Chart tremie progress and quantities
  - (in real time)
- Count tremie pipe lengths



Concrete Quality Testing

During Placement--

- Slump
- Air Content
- Temperature

Verification Drilling

- Purposes:
  - Concrete Quality
  - Panel Contact/Joint Quality
  - Cutoff-Wall---Rock Bottom Contact

- Techniques:
  - 4 inch core for Panels
  - 6 inch core for Panel Joints

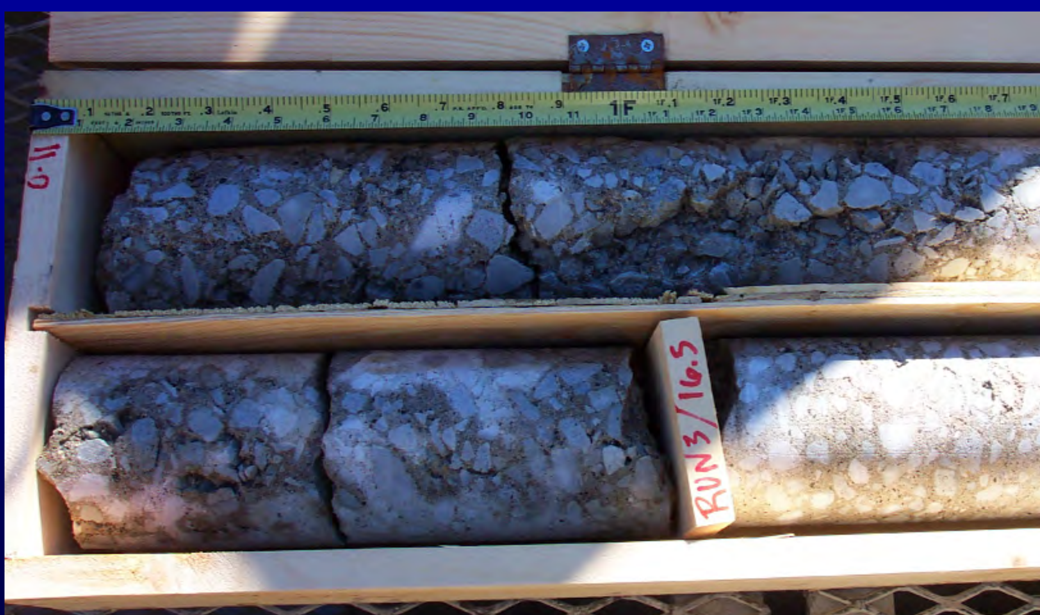
Verification Drilling

Geotechnical and Dam Safety Section
MISSISSINEWA DAM

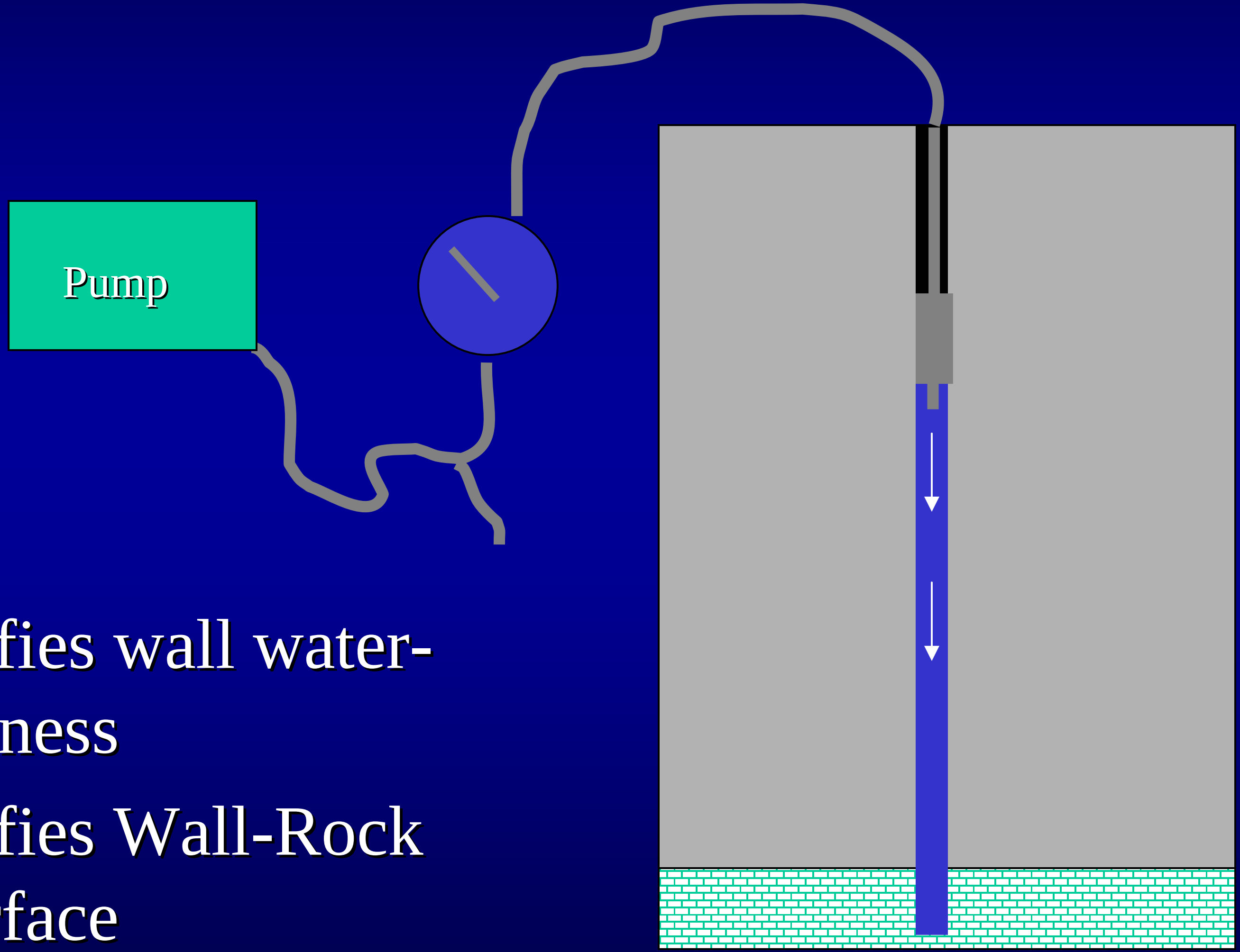
US Army Corps of Engineers
Louisville District

Panel-Rock Contact

What we don’t want!



Borehole Pressure Testing

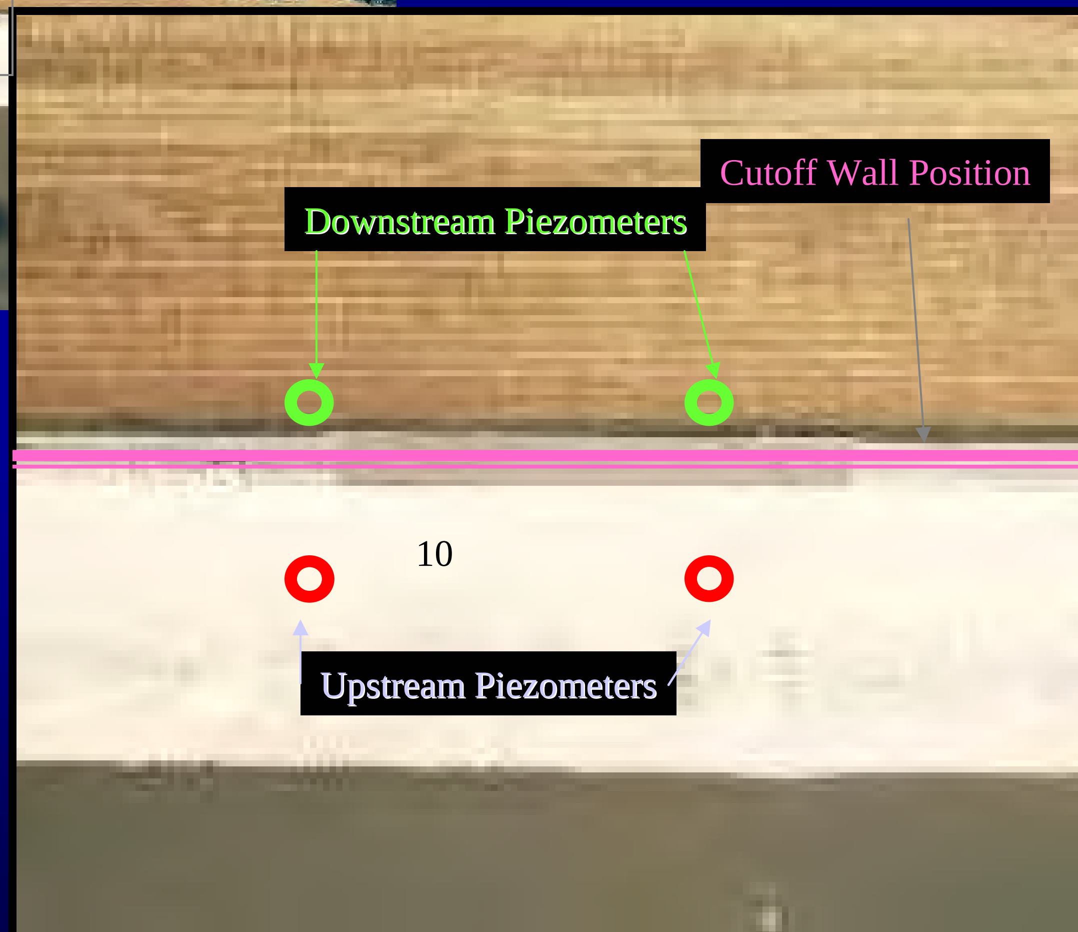


- Verifies wall water-tightness
- Verifies Wall-Rock Interface

Dam Instrumentation

- Purposes
  - Verify dam integrity
  - Check effectiveness of grouting
  - Check effectiveness of concrete cutoff wall
  - Historical record for future use

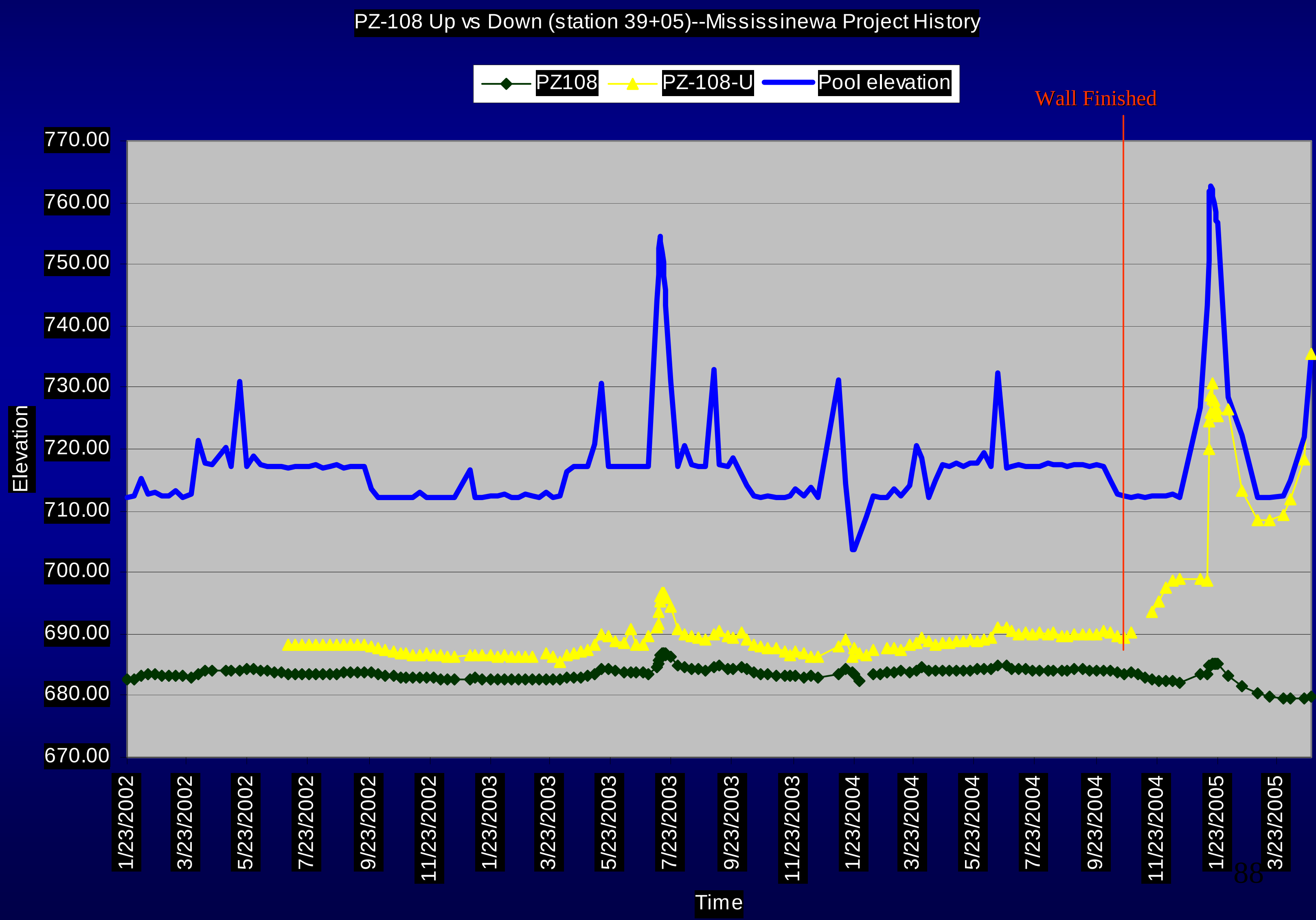
Paired Piezometers



Geotechnical and Dam Safety Section
MISSISSINEWA DAM

US Army Corps of Engineers
Louisville District

Paired Piezometer Plot



What have we learned?

- Solution Features are worse than expected.
- Clearly we were in a failure mode, reinforcing the need for remediation.
- Need for Pool restriction reinforced.
- Pregrouting is required to control slurry loss.
- Need to adjust design to field conditions.
- Cost and Schedule Growth will be governed by Geology.
- Large Contingencies are required for foundation repair projects.

- Final Price Approx. $50 Million.
- Most of the cost growth due to pretreatment grouting.
- No milling production issues related to rock strength.

US Army Corps of Engineers
Louisville District

LOUISVILLE DISTRICT

ESSAYONS

ENGINEER

An Overview of the Dam Safety Program Management Tools (DSPMT)

2005 USACE Infrastructure Conference
3 August, 2005

Objective

- To provide an overview of why this program is needed, what it is and how it is being utilized.

Why is this Software Needed?

- To Support Broad Information Needs of the National Dam Safety Program, including:
  - Documenting the characteristics and condition of the Nation's dams
  - Tracking the existence and progress of dam safety programs
  - Supporting dam safety professionals who are responsible for evaluating and maintaining the safety of dams in the U.S.

Specifically, the DSPMT:

- Allows quantitative, consistent, un-biased evaluation of dam safety programs
- Monitors program progress
- Consistent interface
- Allows exchange of data with other databases
- Simplifies data collection process allowing true One-time data entry to be possible
- Program Review Tool

What is the DSPMT ?

- Free Software for States or Federal Agencies
- Desktop-based Software that keeps the User in control of the data
- Benefits:
  - DSPMT Utilization will reduce/eliminate requests for data because the requesting organization can go directly to the data itself
  - Can result in significant time savings for generating:
    - Annual NDSRB State Evaluation Criteria Reports
    - Peer Review Data
    - NID Submittals
    - NPDP Incident Reports
    - Inputs for Biennial Report to FEMA
    - Unbiased data for self-evaluation or evaluation by others

DSPMT Components

- **Dam Safety Program Performance Measures (DSPPM)**
- **National Inventory of Dams (NID) Electronic Submittal Workflow**
- **Reporting Capabilities to National Oversight Organizations**

DSPMT

Why do we need dam safety program performance measures?

- ***They provide the raw unbiased data necessary for helping to evaluate our dam safety programs, for reporting our accomplishments, and for expressing our program needs to others.***

What are the Dam Safety Program Performance Measures?

- **DSPPM 1 - Dam Safety Program Legislative Authorities & Management Practices**
  - Demonstrates: Adoption **and** implementation of uniform National Dam Safety Program management practices.
- **DSPPM 2 - Dam Safety Staff Size & Relevant Experience**
  - Demonstrates: The trends & fluctuations in an organization's dam safety staff size and relevant experience.
- **DSPPM 3 - Inspections & Evaluations**
  - Demonstrates: Number of dams and the number that **are** and **are not** being inspected & evaluated.
- **DSPPM 4 - Identification & Remediation of Deficient Dams**
  - Demonstrates: Dam Safety program effectiveness in **identifying, prioritizing** and **correcting** critical deficiencies.

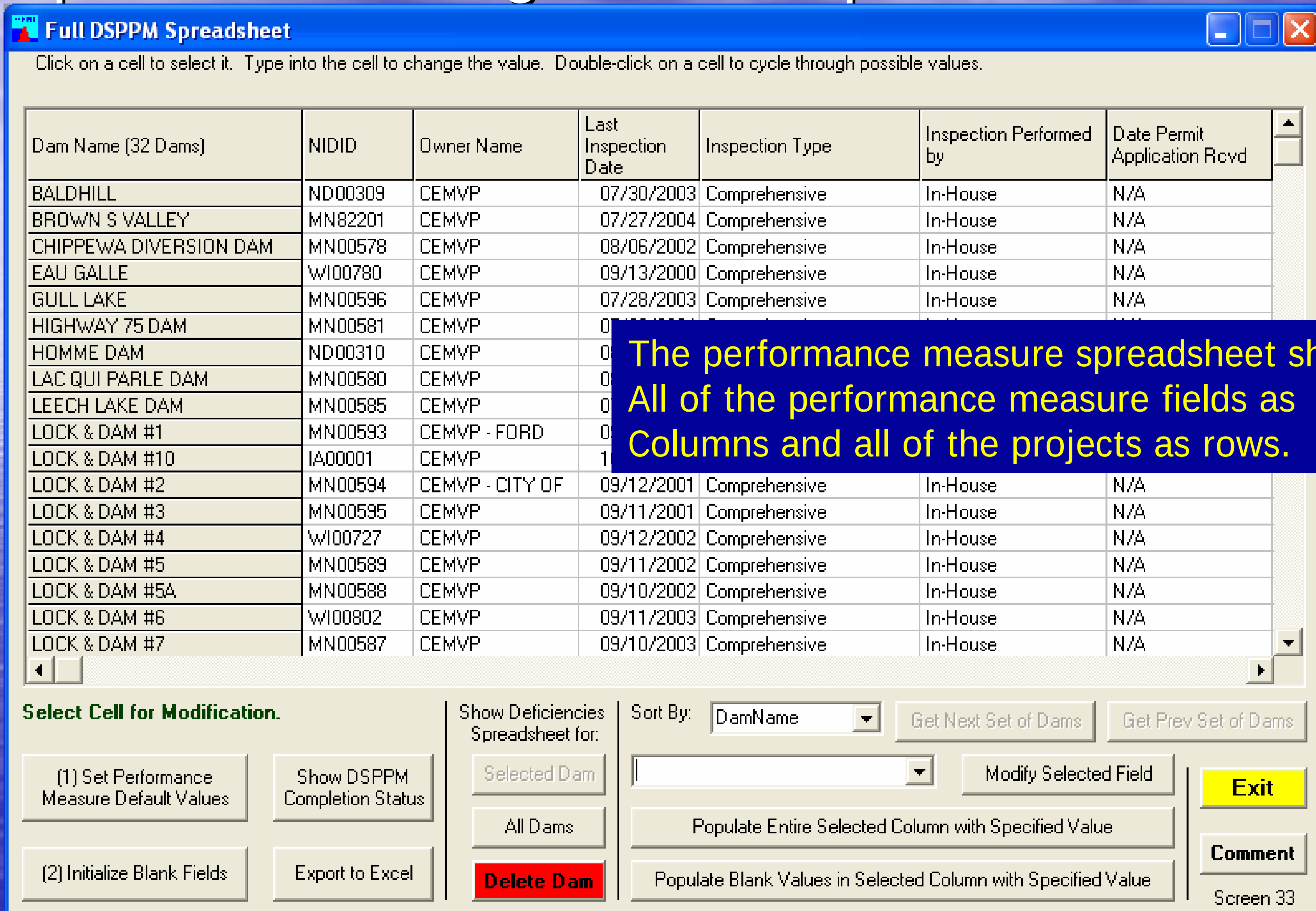
What are the Dam Safety Program Performance Measures?

- **DSPPM 5 - Project Response Preparedness**
  - Demonstrates: Amount of dam safety **training** aimed at maintaining capability to **recognize** & **respond** to conditions that may threaten dam safety & public safety.
  - Demonstrates: Extent of up-to-date project (dam) **documentation** (e.g. as-builts).
- **DSPPM 6 - Agency & Public Response Preparedness**
  - Demonstrates: Extent of agency and public (local) emergency **awareness** & **preparedness**.
  - Demonstrates: Effectiveness in **development** of EAP's & **coordinating** EAP's with local jurisdictions.
- **DSPPM 7 - Unscheduled Dam Safety Program Actions**
  - Demonstrates: Magnitude of unscheduled, non-deferrable **efforts** and **incidents** that adversely impact routine program execution.

DSPPM 7 will be Expanded very soon to Include:

- Capability for Notification of Distress in Civil Works Structures to Hq including information such as the following:
  - Date of incident
  - Date of site visit
  - Category/ reason for site visit
  - Did the dam fail? (current)
  - Failure type
  - Failure mode
  - Was the dam previously identified as being deficient? (current)
  - Was the actual failure mode previously identified as a deficiency? (current)
  - Were emergency remedial actions necessary?
  - Were pool restrictions imposed?
  - Etc.

The Performance Measures are implemented using detailed spreadsheets

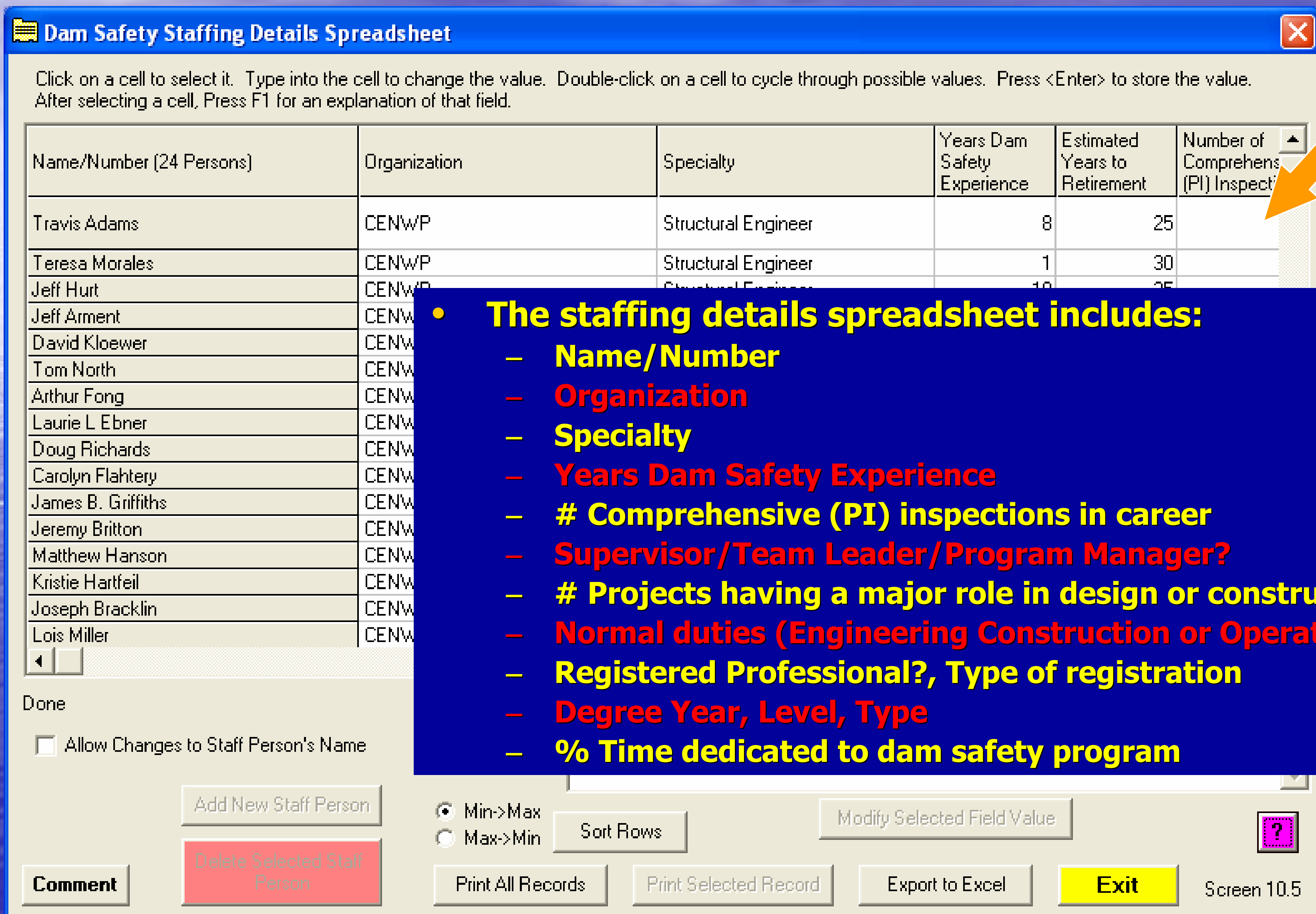


The performance measure spreadsheet shows All of the performance measure fields as Columns and all of the projects as rows.

Specifically, the Performance Measure Spreadsheet is used for:

- Supporting generation of the biennial report to FEMA
  - Number of Dams
  - Hazard Potential Classification Information
  - Inspection Information
  - Remediation Needs and Accomplishments
  - Emergency Action Planning Performance
- Supporting general data requests from both within and external to the Agency

The Staffing Details Spreadsheet

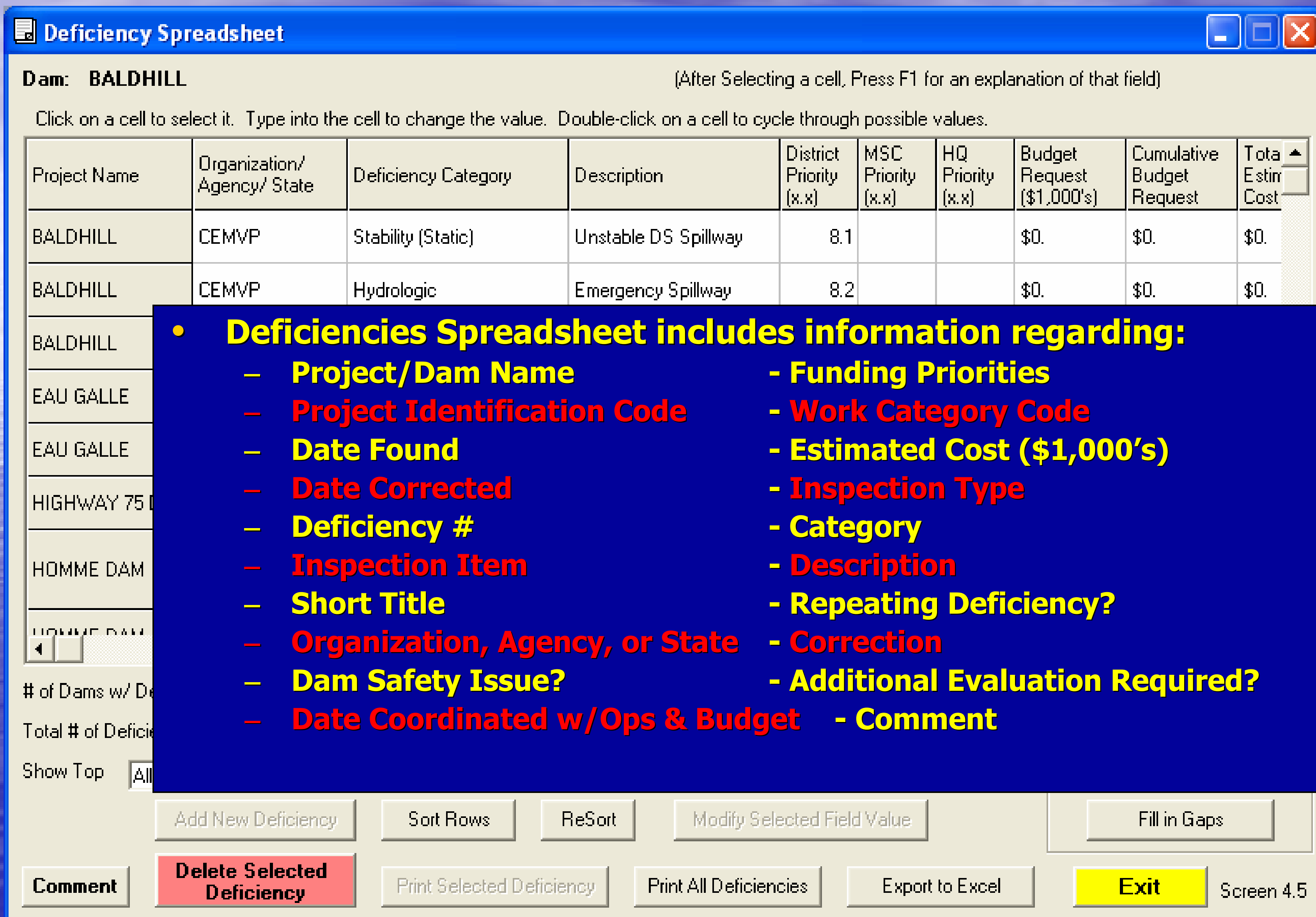


- **The staffing details spreadsheet includes:**
  - **Name/Number**
  - **Organization**
  - **Specialty**
  - **Years Dam Safety Experience**
  - **# Comprehensive (PI) inspections in career**
  - **Supervisor/Team Leader/Program Manager?**
  - **# Projects having a major role in design or construction**
  - **Normal duties (Engineering Construction or Operations)**
  - **Registered Professional?, Type of registration**
  - **Degree Year, Level, Type**
  - **% Time dedicated to dam safety program**

Specifically, the Staffing Details Spreadsheet can be used for:

- Evaluating the number of FTE's
- Evaluating an Organization's capability to execute the dam safety program
- Supporting generation of the draft biennial report to FEMA
  – Number of FTE's (i.e. Staff multiplied by % of time dedicated to dam safety)
  – Specialty category (i.e. Geotechnical Engineer, Structural Engineer, etc.)

The Deficiencies Spreadsheet

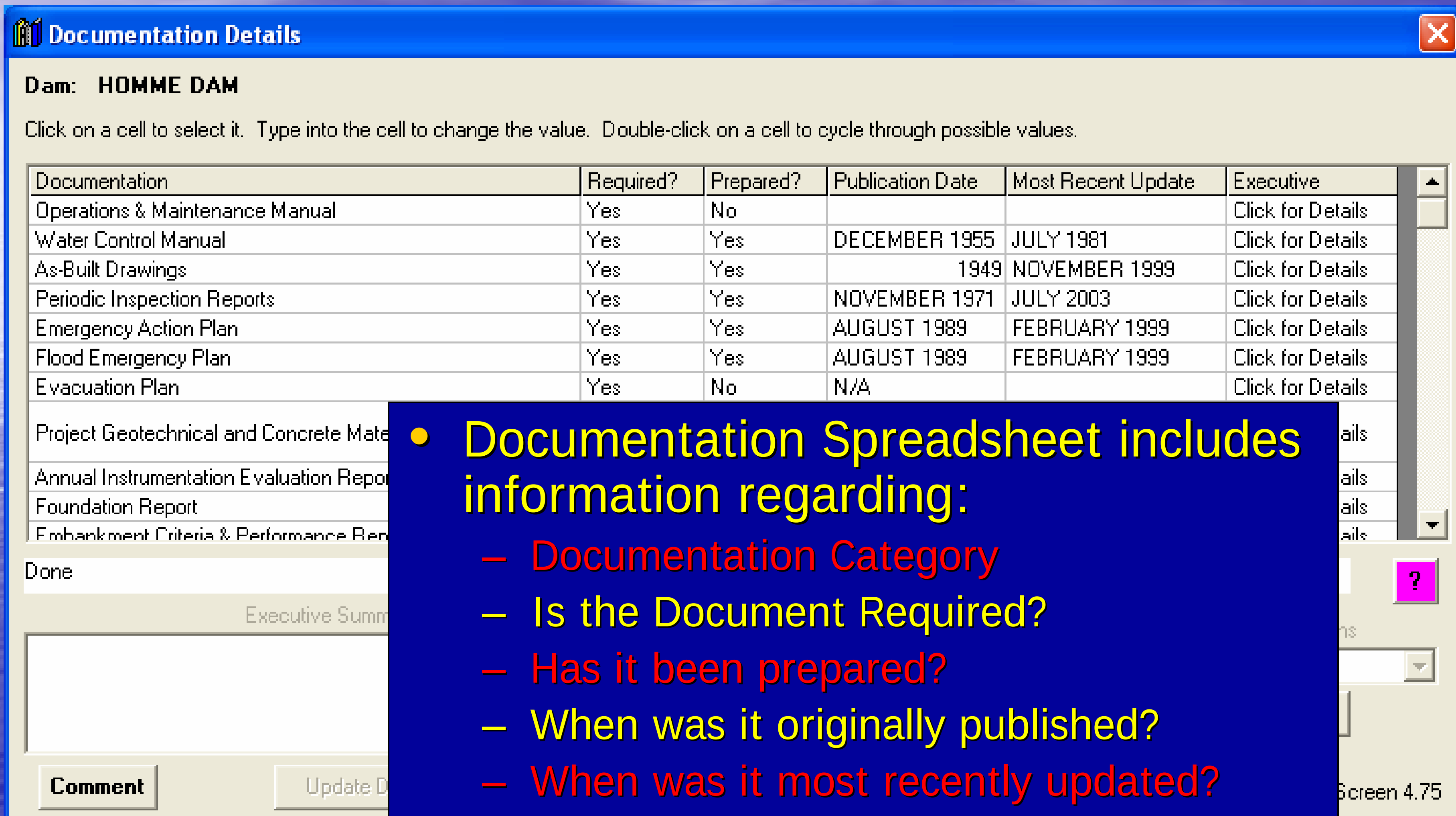


- **Deficiencies Spreadsheet includes information regarding:**
  - **Project/Dam Name** - **Funding Priorities**
  - **Project Identification Code** - **Work Category Code**
  - **Date Found** - **Estimated Cost ($1,000's)**
  - **Date Corrected** - **Inspection Type**
  - **Deficiency #** - **Category**
  - **Inspection Item** - **Description**
  - **Short Title** - **Repeating Deficiency?**
  - **Organization, Agency, or State** - **Correction**
  - **Dam Safety Issue?** - **Additional Evaluation Required?**
  - **Date Coordinated w/Ops & Budget** - **Comment**

Specifically, the Deficiencies Spreadsheet is used for:

- Documenting the specific remediation needs within the district, plans for studies, and remediation accomplishments
- Supporting the performance measure spreadsheet in generating the biennial report to FEMA
  - Remediation Needs and Accomplishments
- Providing budgeting guidance from the Districts to Division on prioritization of deficiencies and developing a remediation plan.
- Reviewing budgeting guidance from the Districts at the Division level, establishing a Division ranking for all deficiencies within the Division and communicating that ranking to Headquarters and back to the Districts.

The Documentation Spreadsheet

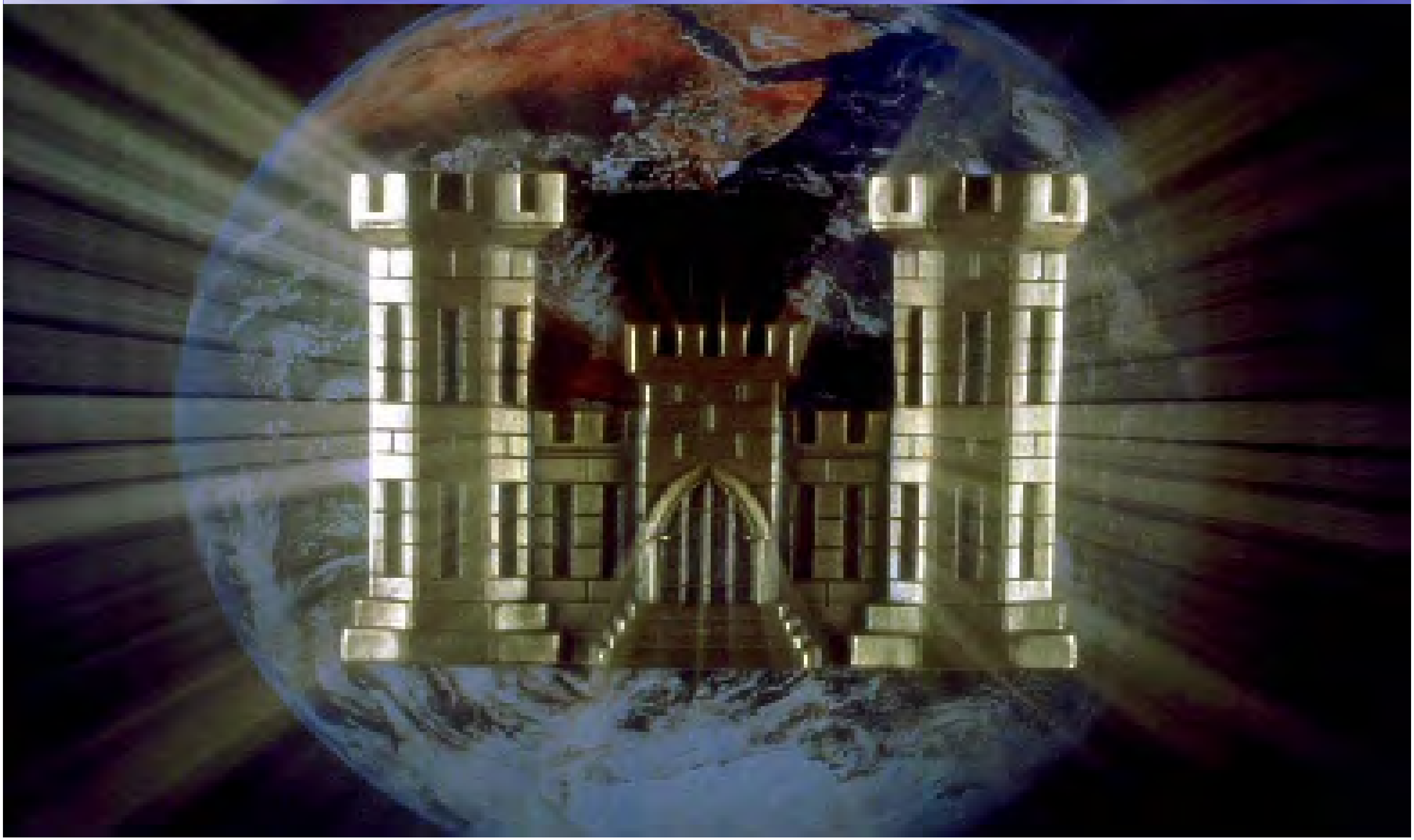


- Documentation Spreadsheet includes information regarding:
  - Documentation Category
  - Is the Document Required?
  - Has it been prepared?
  - When was it originally published?
  - When was it most recently updated?
  - Executive summary details

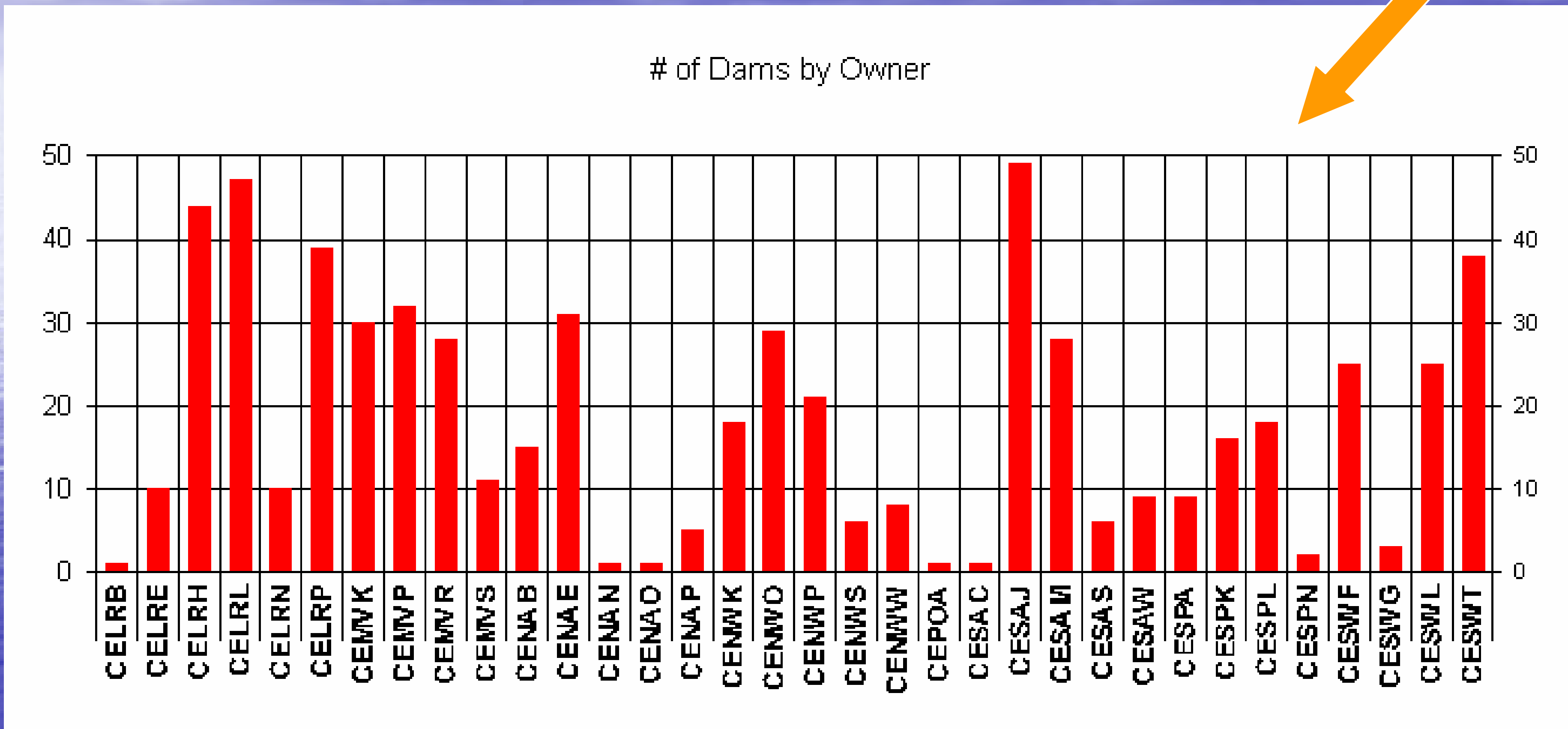
Specifically, the Documentation Spreadsheet can be used for:

- Supporting generation of the biennial report to FEMA
  - Emergency Action Planning Performance
- Providing executive summaries of periodic inspection reports, and other reports, to the Division.

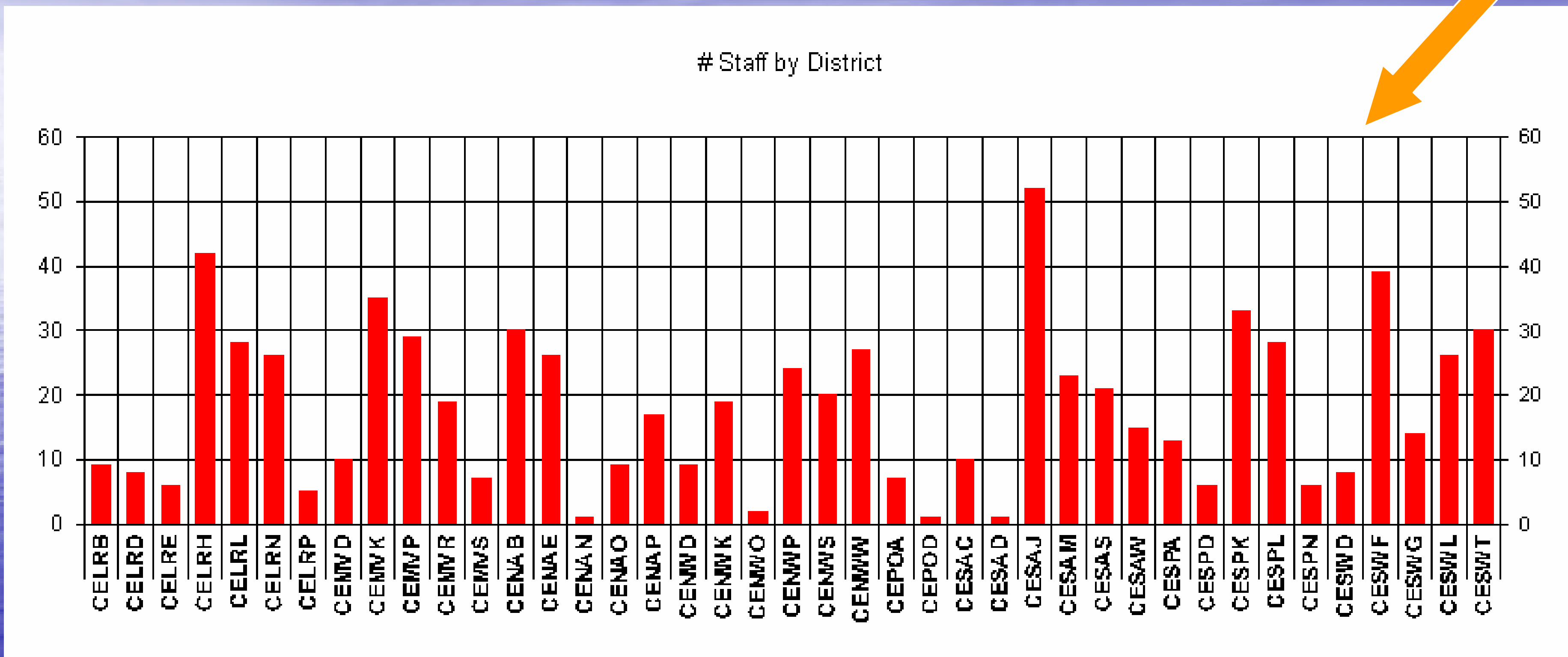
Examples of Performance Measure Outputs within USACE



Number of Dams, (by District) (617 Total)

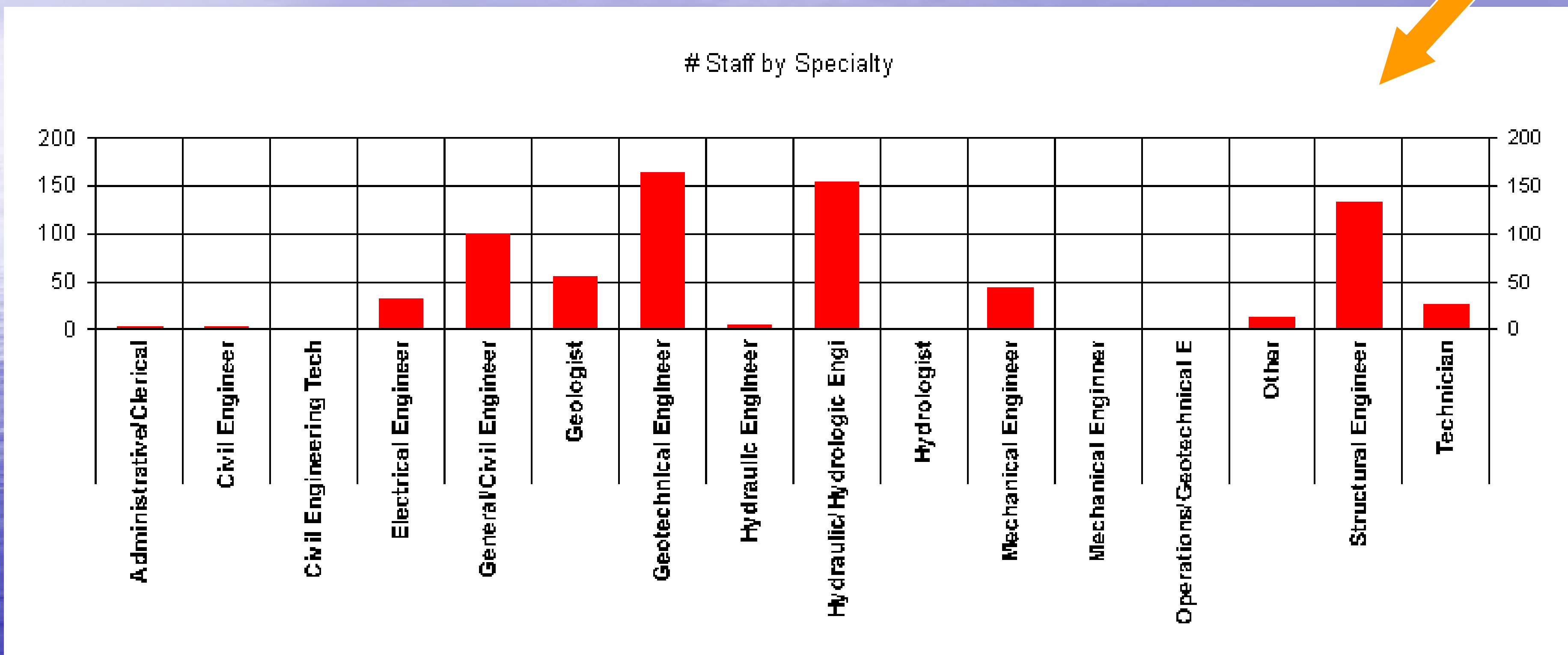


Dam Safety Staff Size (By District)



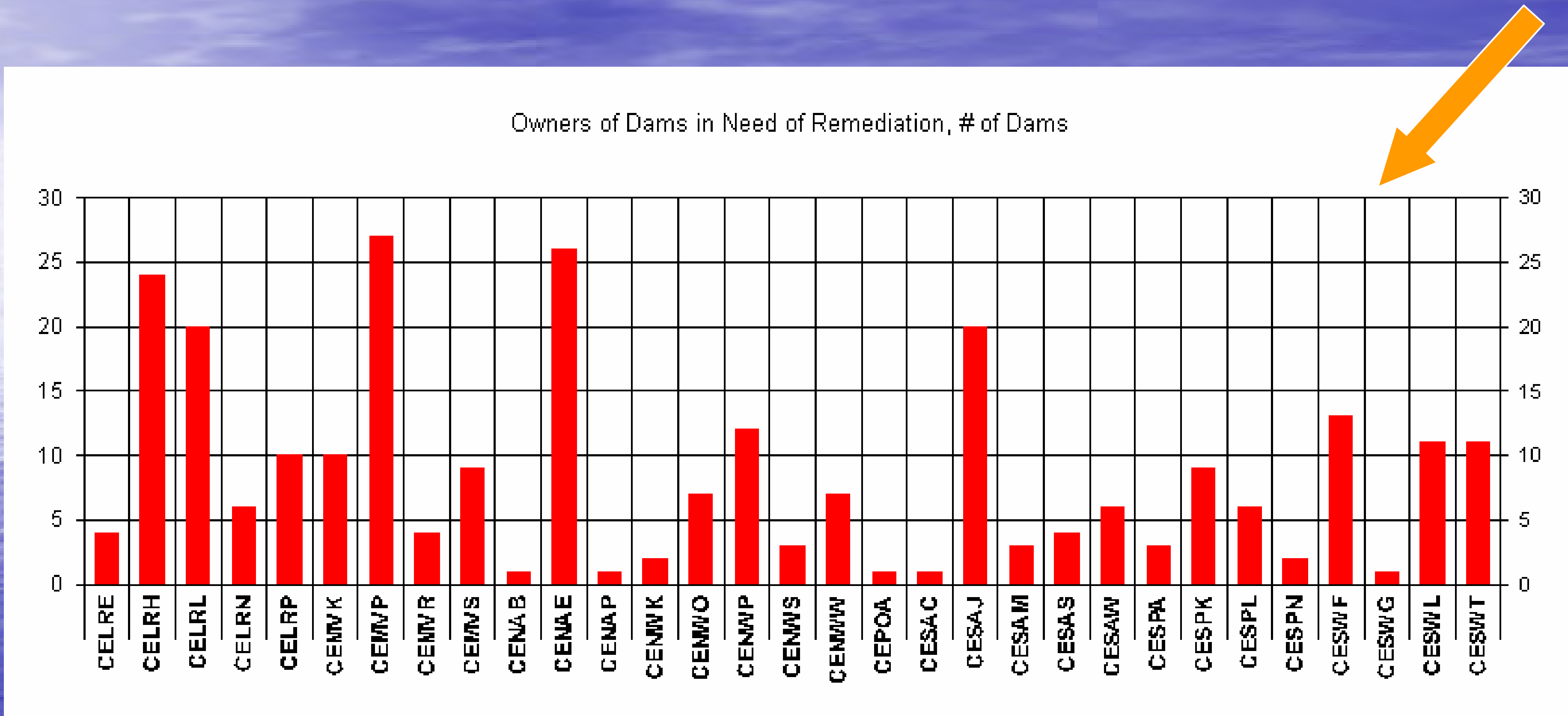
- Total persons contributing to dam safety program (733 persons)

Dam Safety Staff (by Specialty)

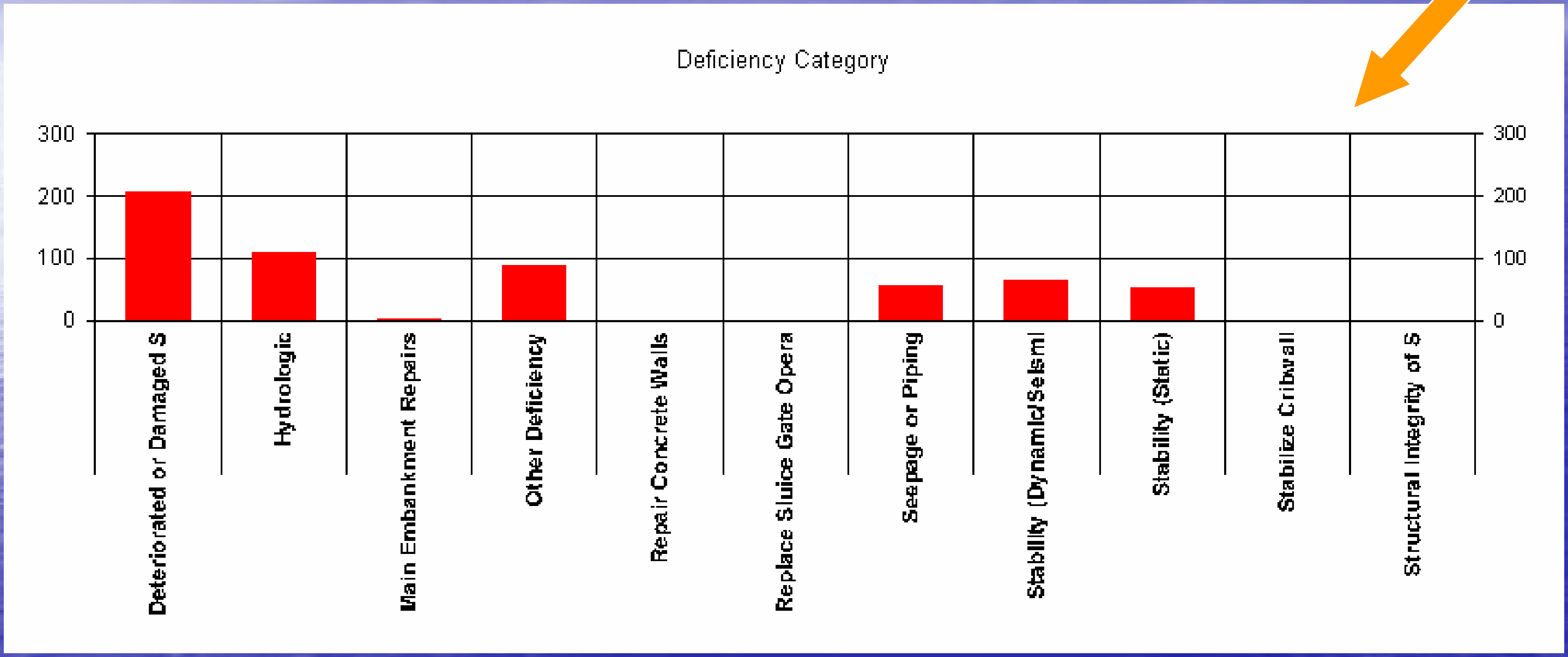


- The data indicates that the dam safety staff consists primarily of Geotechnical, H&H and Structural engineers.

Dams in Need of Remediation



Identified Deficiencies



- Identified deficiencies primarily consist of deteriorated or damaged structures, and hydrologic deficiencies. Of significance, seepage and piping and static stability is identified, or is identified for future study, for 50 or more structures.

DSPMT Components

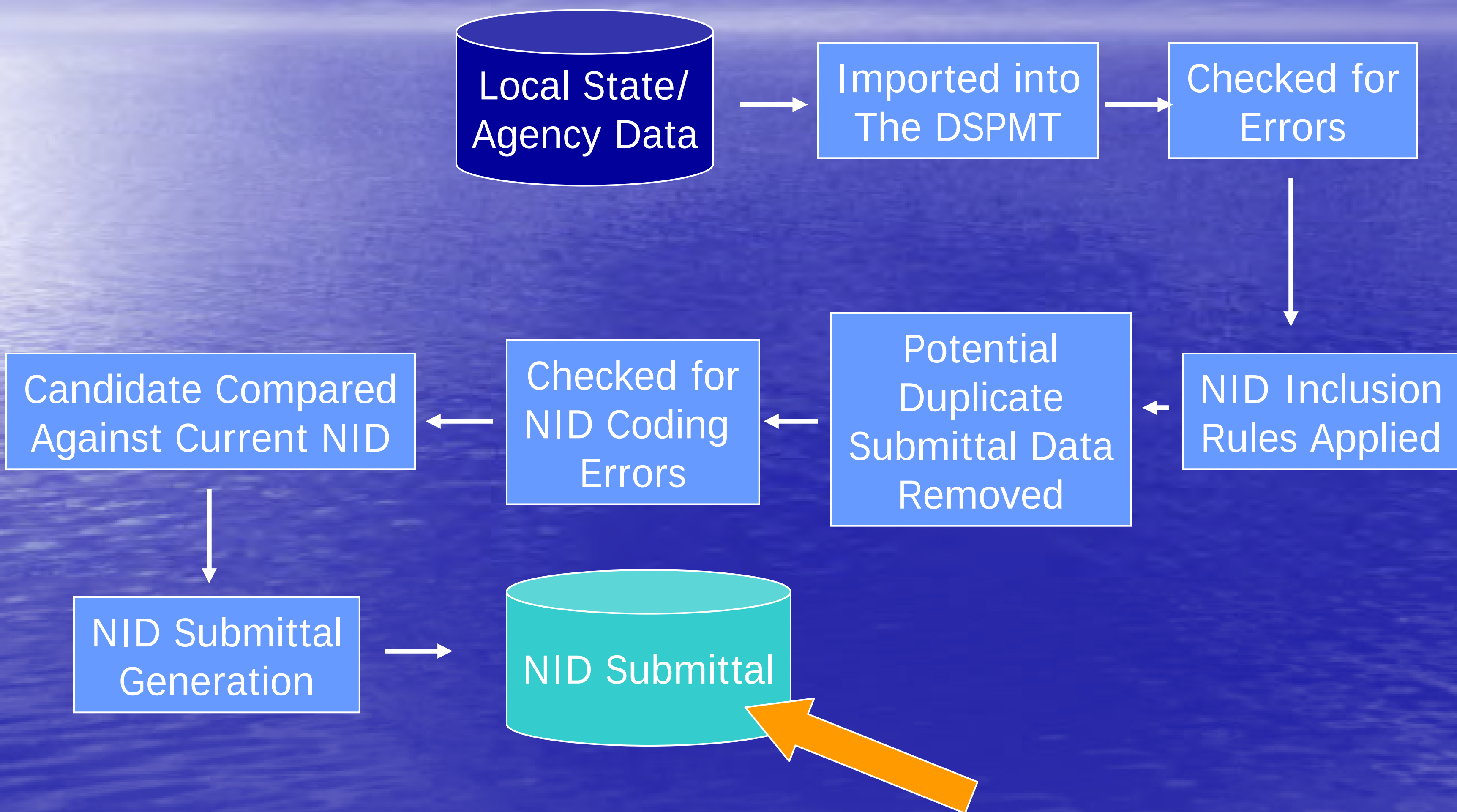
- **Dam Safety Program Performance Measures (DSPPM)**
- **National Inventory of Dams (NID) Electronic Submittal Workflow**
- **Reporting Capabilities to National Oversight Organizations**

DSPMT

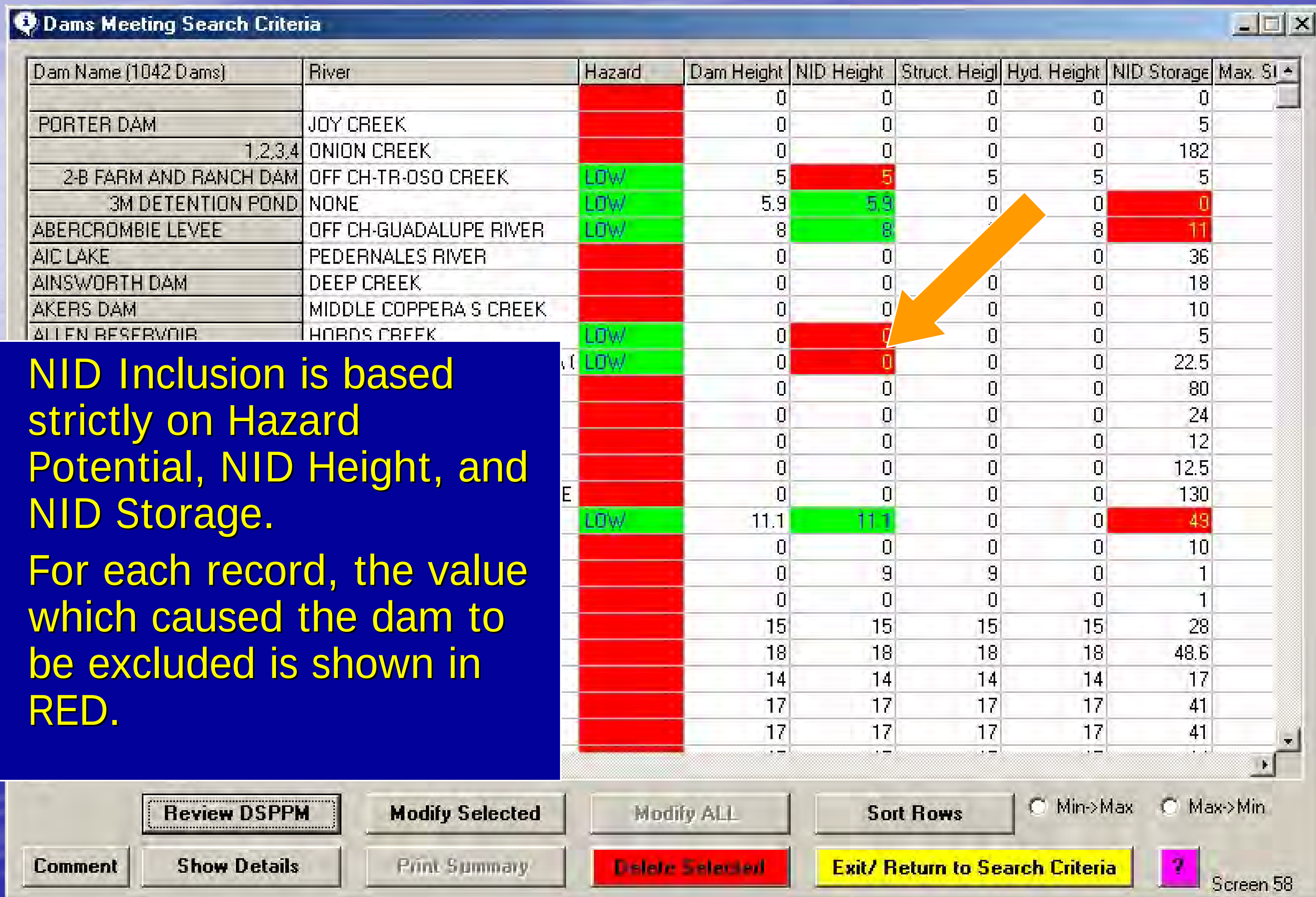
What is the NID Electronic Submittal Workflow?

"A natural extension of the NID and the Dam Safety Program Management Tools (DSPMT) to help users provide a consistent, error-checked electronic submittal of inventory information."

NID Electronic Submittal Workflow

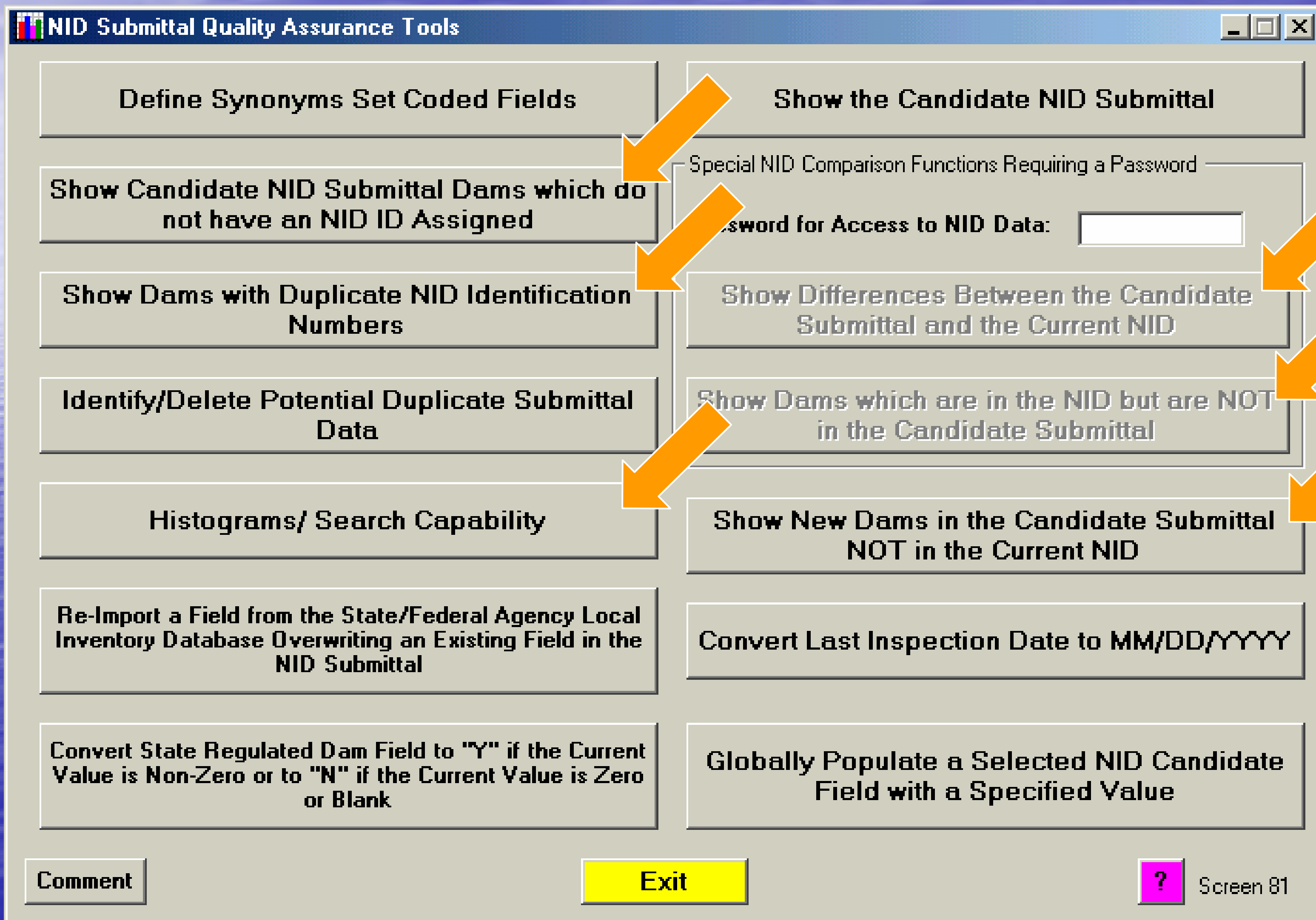


Applying the NID Inclusion Rules



- NID Inclusion is based strictly on Hazard Potential, NID Height, and NID Storage.
- For each record, the value which caused the dam to be excluded is shown in RED.

Quality Assurance Tools Interface



DSPMT Components

- **Dam Safety Program Performance Measures (DSPPM)**
- **National Inventory of Dams (NID) Electronic Submittal Workflow**
- **Reporting Capabilities to National Oversight Organizations**

DSPMT

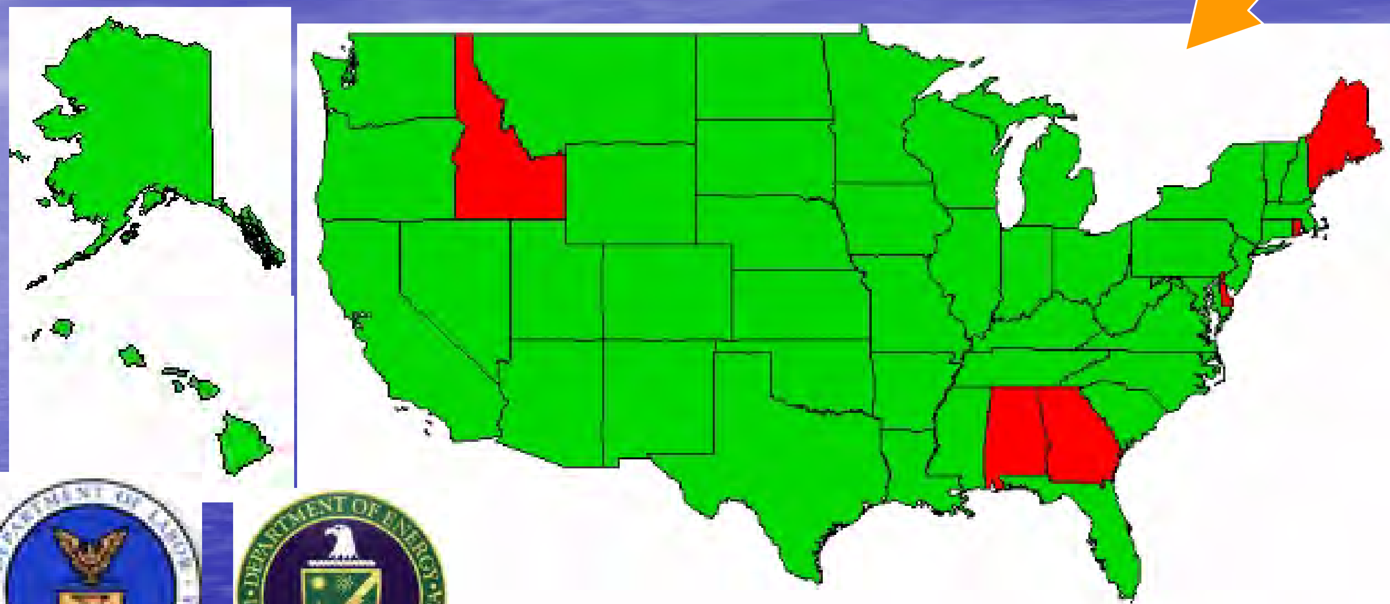
Why are Reporting Capabilities Needed to National Oversight Organizations?

"Facilitating the development, documentation, and modification of practices by supporting performance measures which directly address all aspects of an organizations dam safety program."

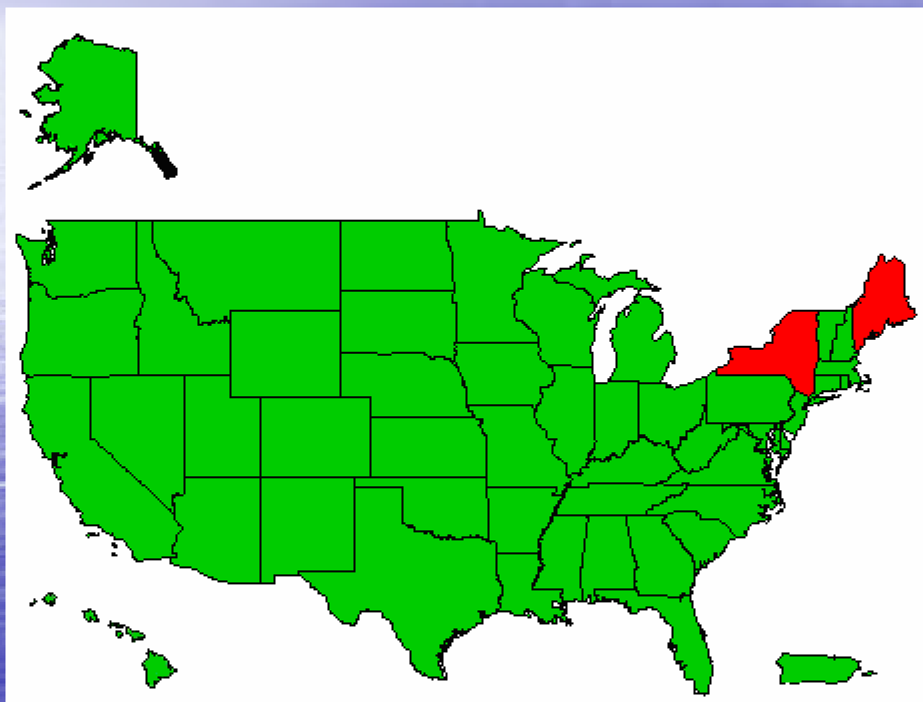
What National Data Collection Efforts have Utilized the DSPMT?

- 2002 NID Update
- 2003 NDSRB State Evaluation Criteria Reports (2002 Reporting Year)
- 2004 NDSRB State Evaluation Criteria Reports (2003 Reporting Year)
- 2005 Combined NDSRB/ASDSO Questions (State Evaluation Criteria Report + ASDSO Annual Survey), (2004 Reporting Year)
- 2004 Update of State Regulated Dam Field in the 2002 NID
- 2004 Update of USACE Dam Safety Deficiencies and Budgeting Priorities for FY06
- 2005 Generation of the draft USACE Biennial Report to FEMA (Reporting Years 2004-2005) (Data collection effort completed)
- 2005 NID Update (effort underway)

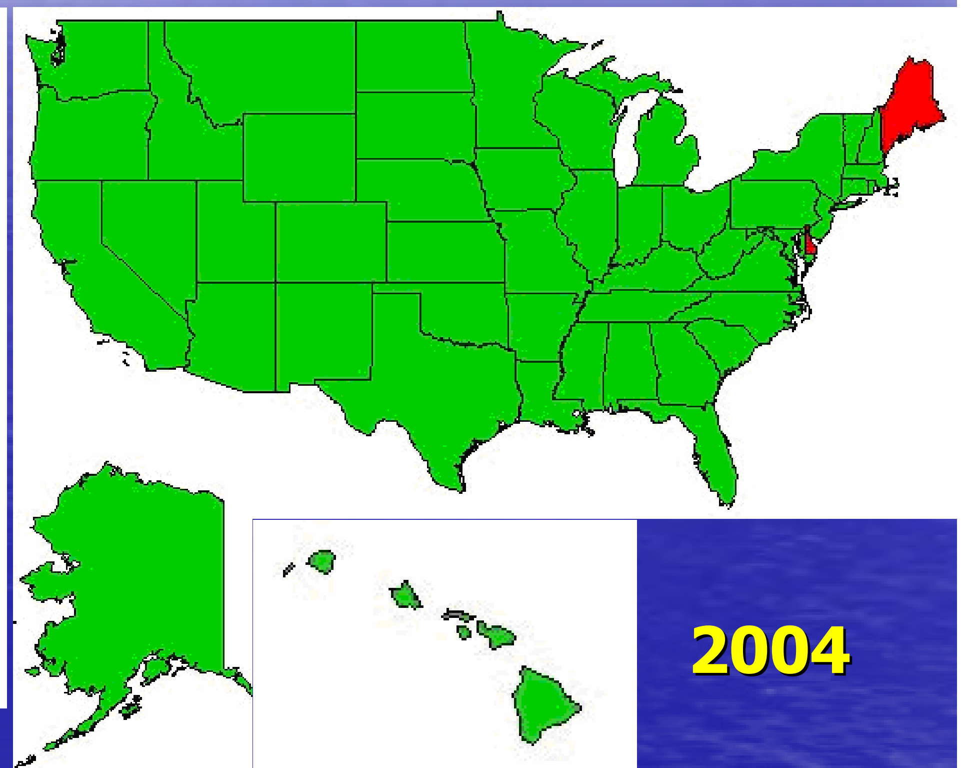
NID Electronic Submittal Status (9/16/2002)



State Participation in the 2003, 2004 NDSRB State Evaluation Criteria Report



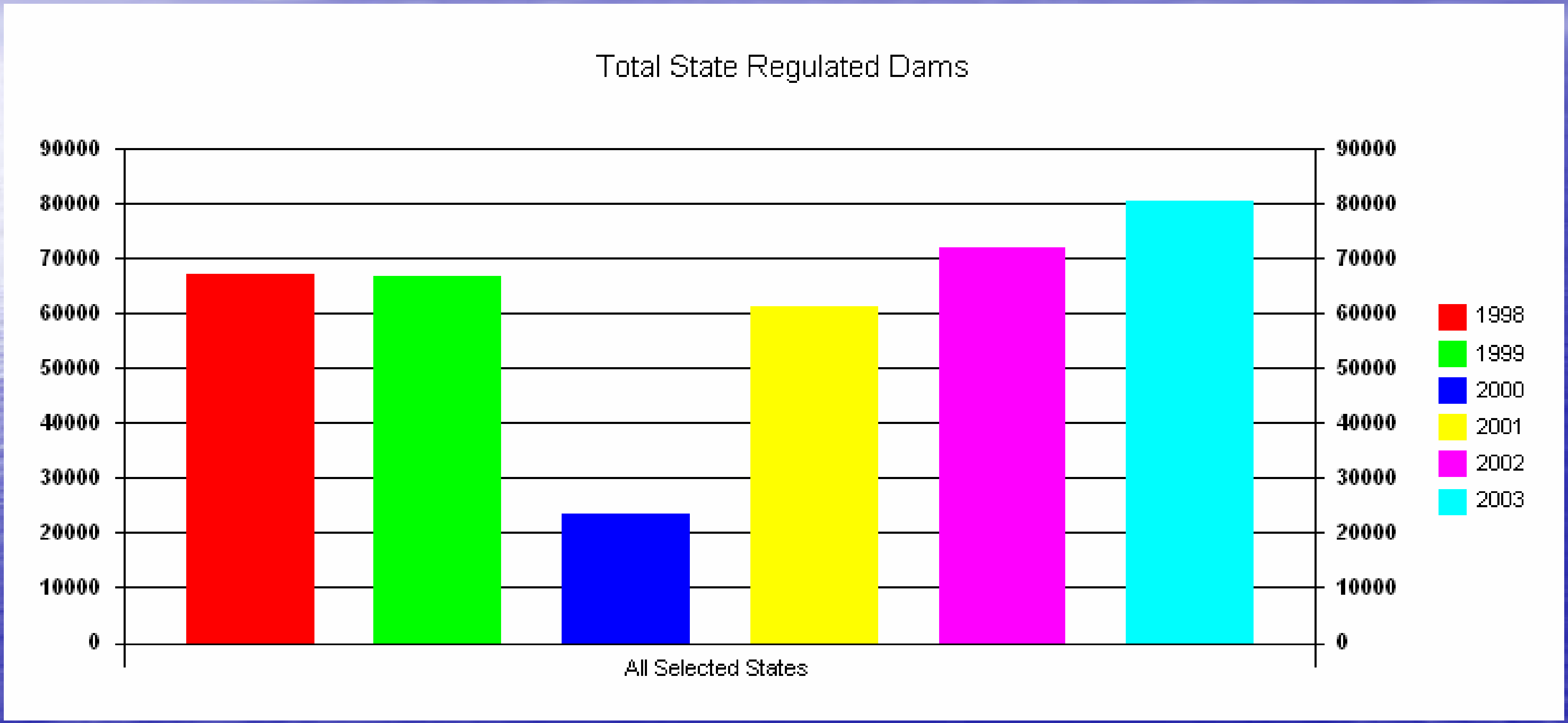
2003



2004

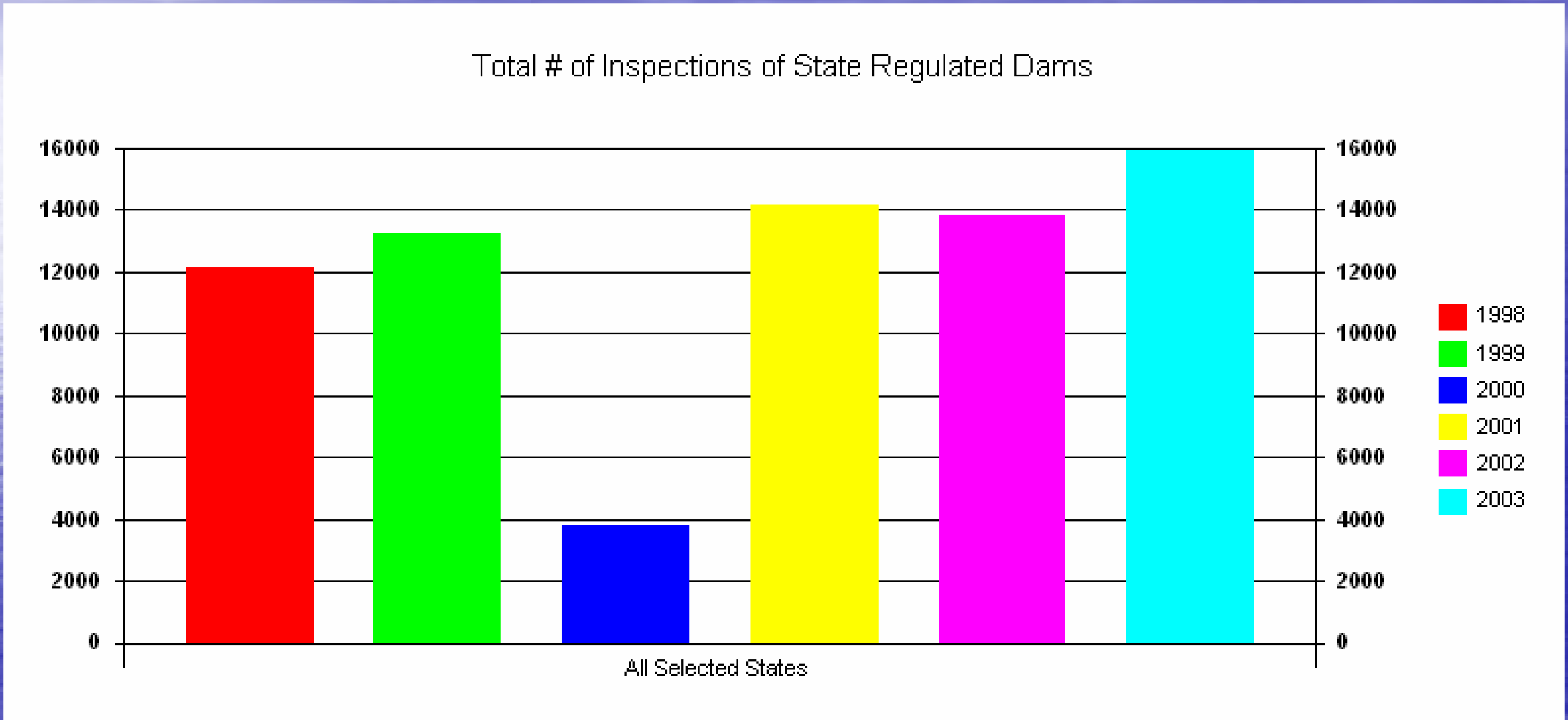
- Green indicates that the State provided the NDSRB data.

Sample Timeline Data from NDSRB Report



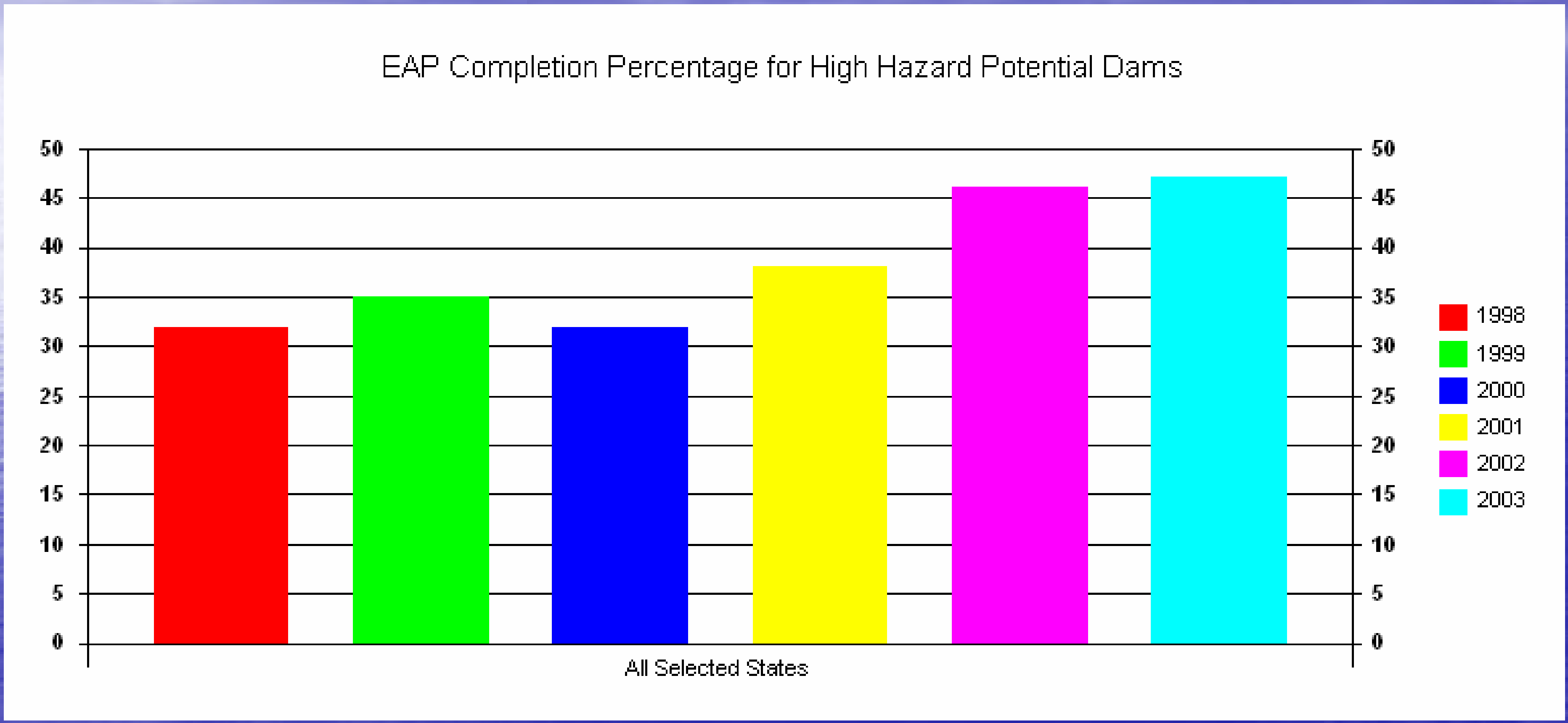
- Total Number of State Regulated Dams

Sample Timeline Data from NDSRB Report



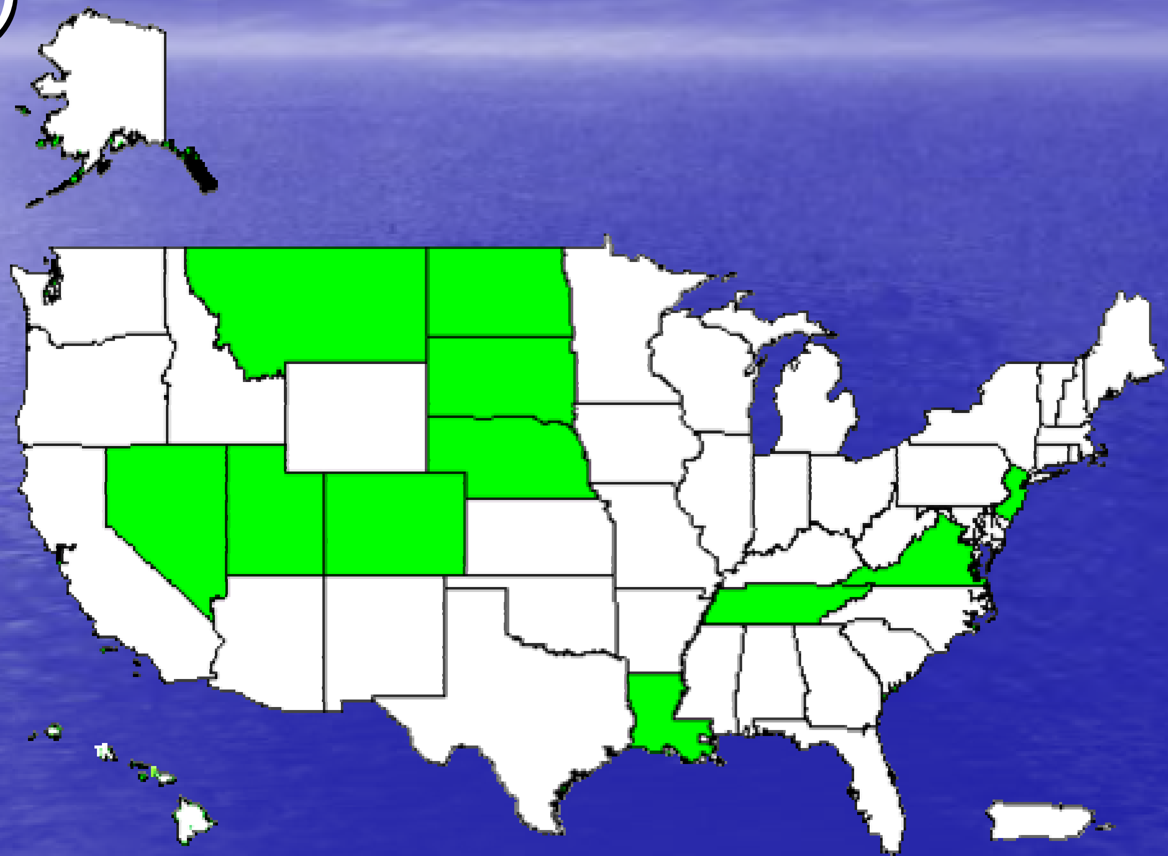
- Total Number of Inspections

Sample Timeline Data from NDSRB Report



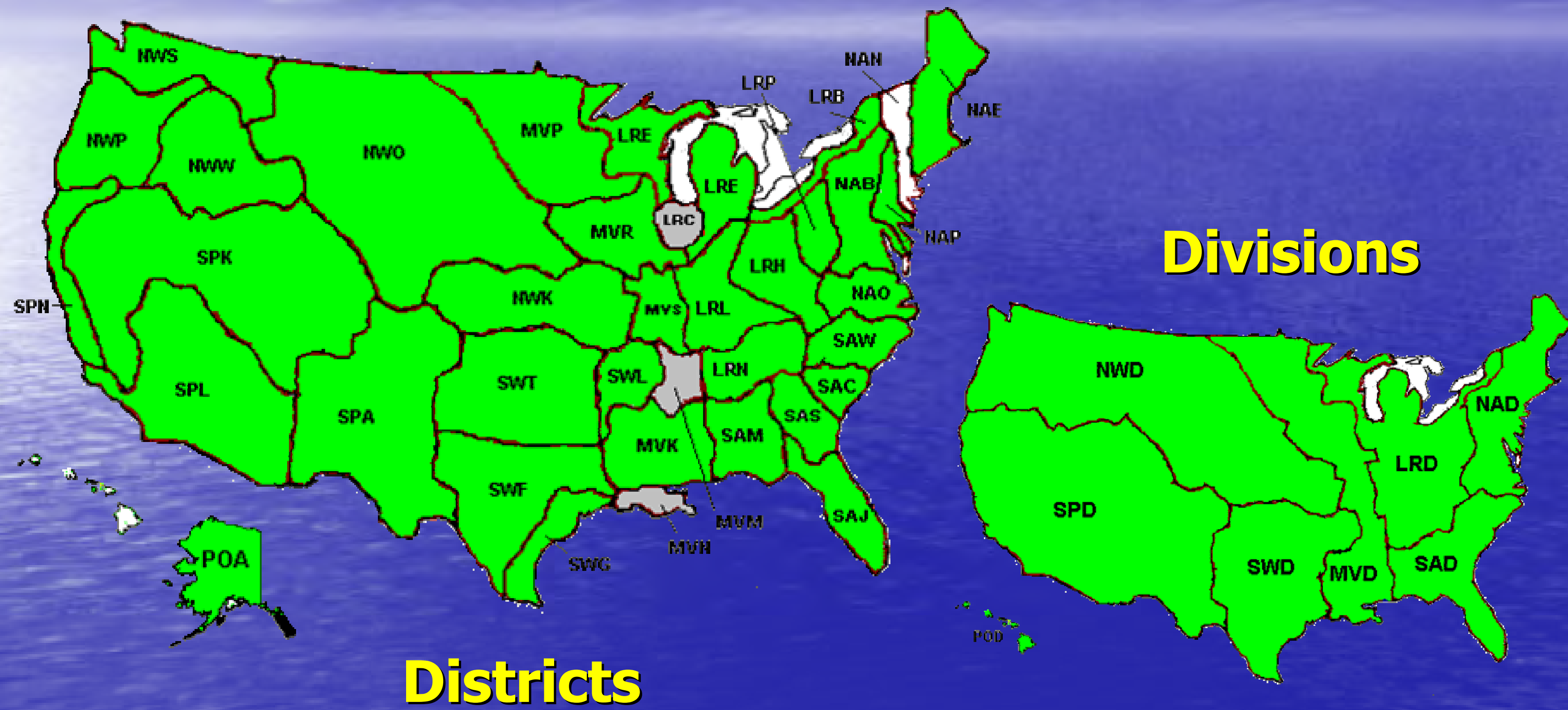
- EAP Completion % for High Hazard Potential Classification Dams

State Participation in the 2005 Combined NDSRB/ASDSO Questions (So Far)



- Green indicates that the State has provided responses to the combined NDSRB/ASDSO questions.

USACE District/Division Participation in Providing Inputs for the Biennial Report to FEMA in 2005

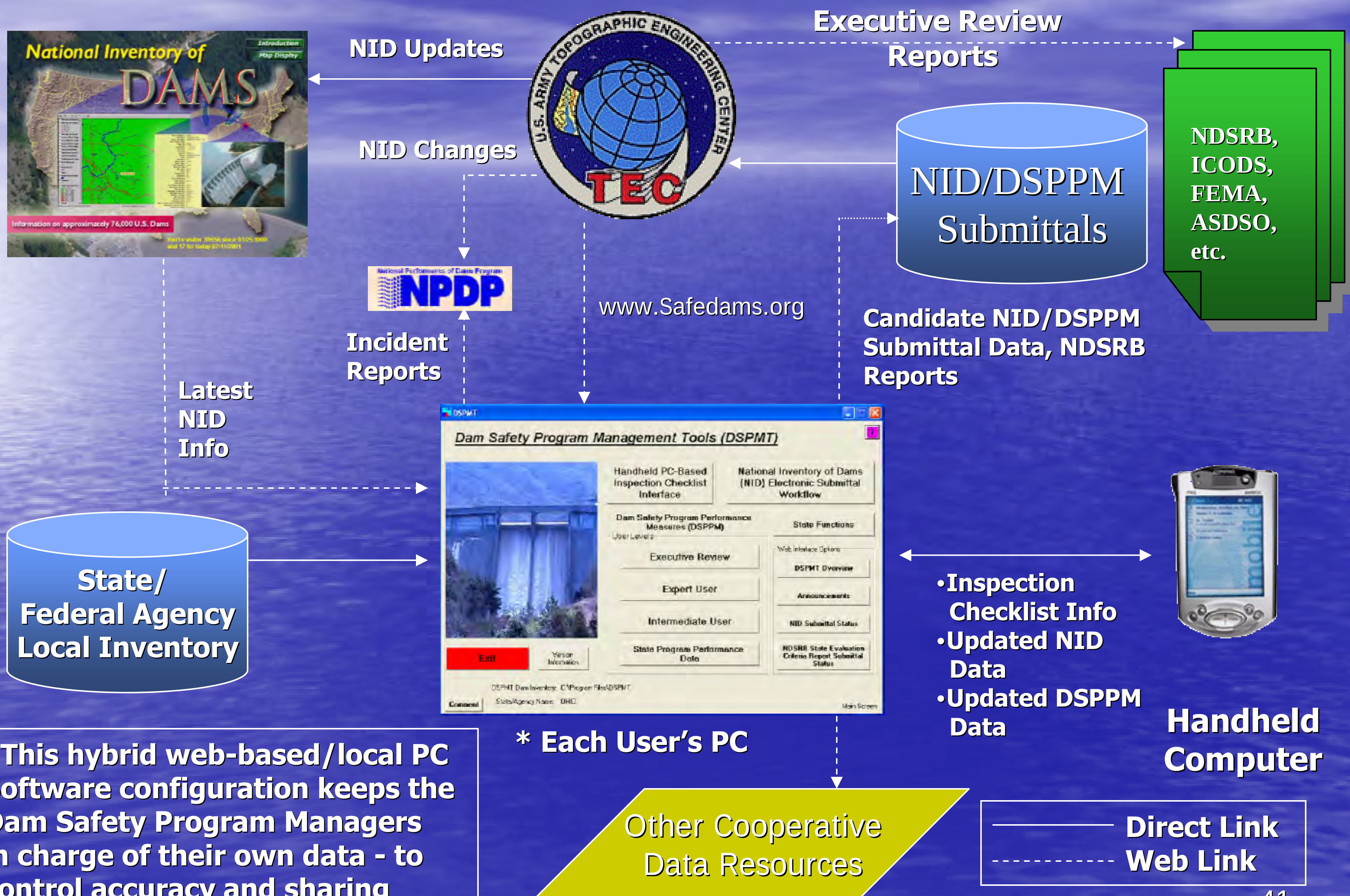


- Green indicates that the Organization provided DSPMT-format electronic submittal data

Where is this going?

- Continued Utilization of DSPMT for Updating the NID
  - Short Term Goal: Annually
  - Longer Term Goal: In Near-Real Time
- Continued Utilization of DSPMT for USACE biennial reporting to FEMA
- Utilization of DSPMT for tracking SPRA within USACE
- Continued Utilization of DSPMT for Combined NDSRB/ASDSO reporting of State Program Performance data
- Incorporation of CRS questions into combined NDSRB/ASDSO/CRS annual reporting starting in 2006

DSPMT Information Flow



*This hybrid web-based/local PC Software configuration keeps the Dam Safety Program Managers in charge of their own data - to control accuracy and sharing

Please Stop by the USACE TEC Exhibit booth for a Demonstration

- For help installing or utilizing the software contact Mike Grounds

  Phone: (256) 771-0014

  e-mail: mike@riversrus.com

US Army Corps of Engineers
Sacramento District

SUCCESS DAM SEISMIC REMEDIATION

US Army Corps
of Engineers
Sacramento District

Success Seismic Remediation Project
Introduction

- Overview
  - Seismic Problem at Success Dam
  - Recent Milestones
  - Risk Analysis and Operating Restriction
  - Alternative Selection
  - Current Status
  - Success Spillway Enlargement
  - Challenges

Success Seismic Remediation Project
Location Map

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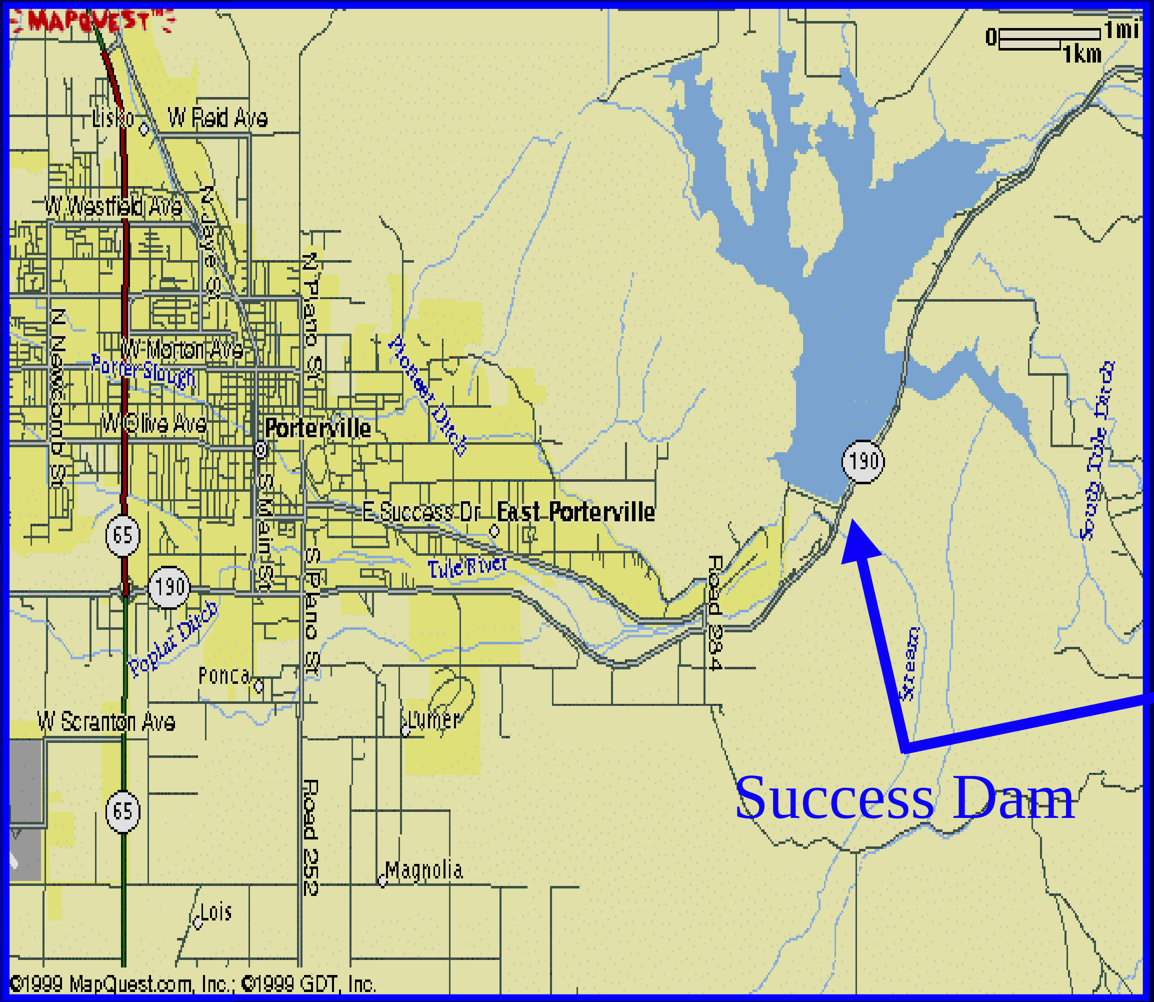

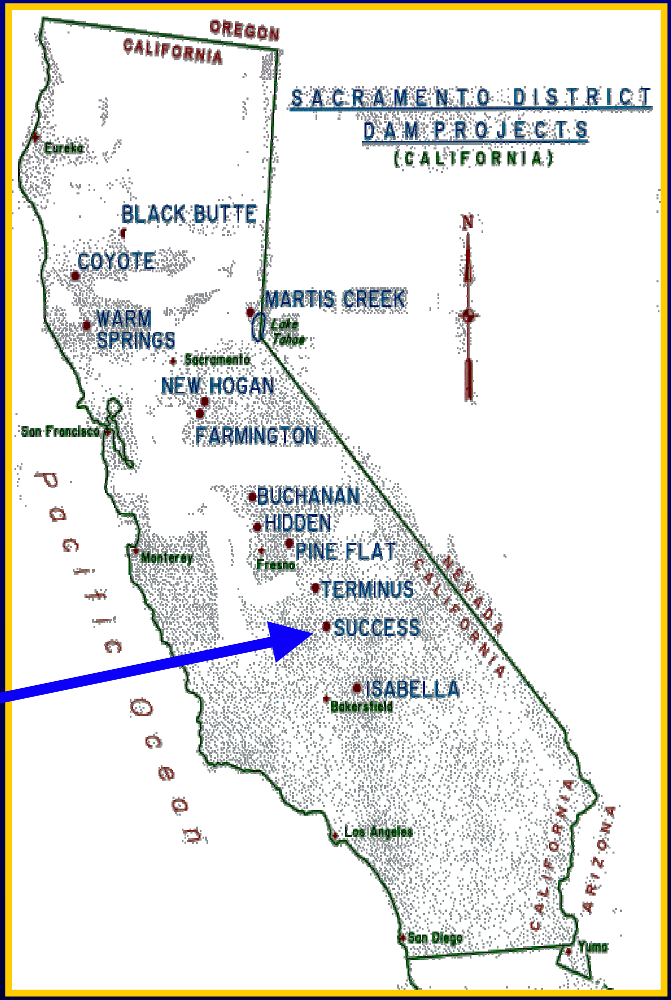

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Success Seismic Remediation Project Key
Key Facts

- Dual Purpose Reservoir – Flood Control & Irrigation
- Completed in 1961
- Original Cost $14.1M
- 185 ft high X 3,450 ft long
- Earth-filled dam
- Storage capacity = 82,300 acre-ft
- Provides 47-year flood protection to the city of Porterville and 200,000 acres downstream

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Success Seismic Remediation Project

Primary Earthquake Sources

- Active Faults within 100-mile radius
  - Premier Fault – 13 miles (M 6.75) MCE *
  - San Andreas – 72 miles (M 8.0) OBE **
  - Owens Valley – 52 miles (M 7.6)
  - White Wolf – 57 miles (M7.5)

- *Maximum Credible Earthquake – worst predicted earthquake (max ground acceleration = 0.28g)
- **Operating Basis Earthquake – expected during life of project (max ground acceleration= 0.1g)

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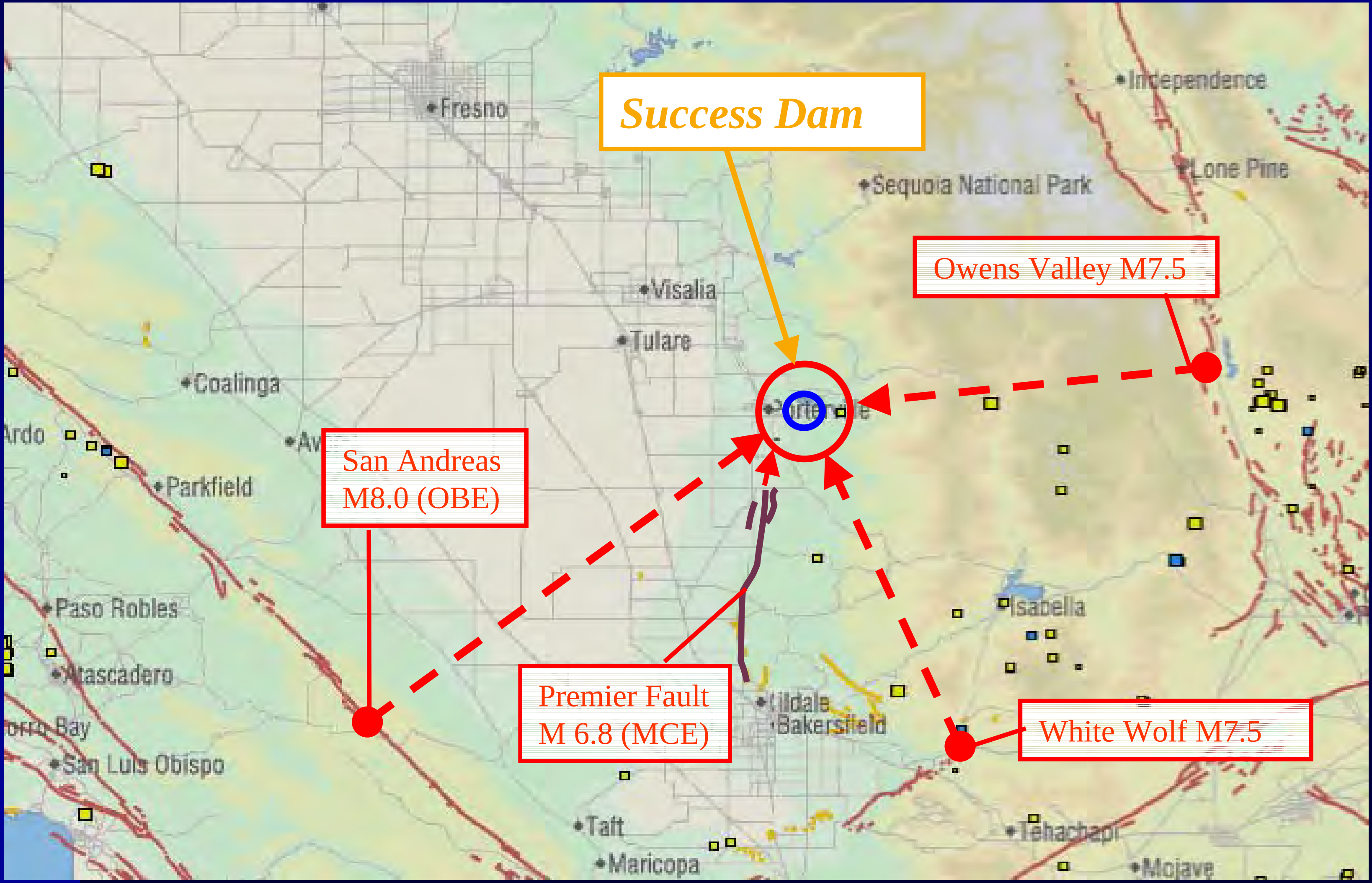
Success Seismic Remediation Project
Primary Seismic Sources



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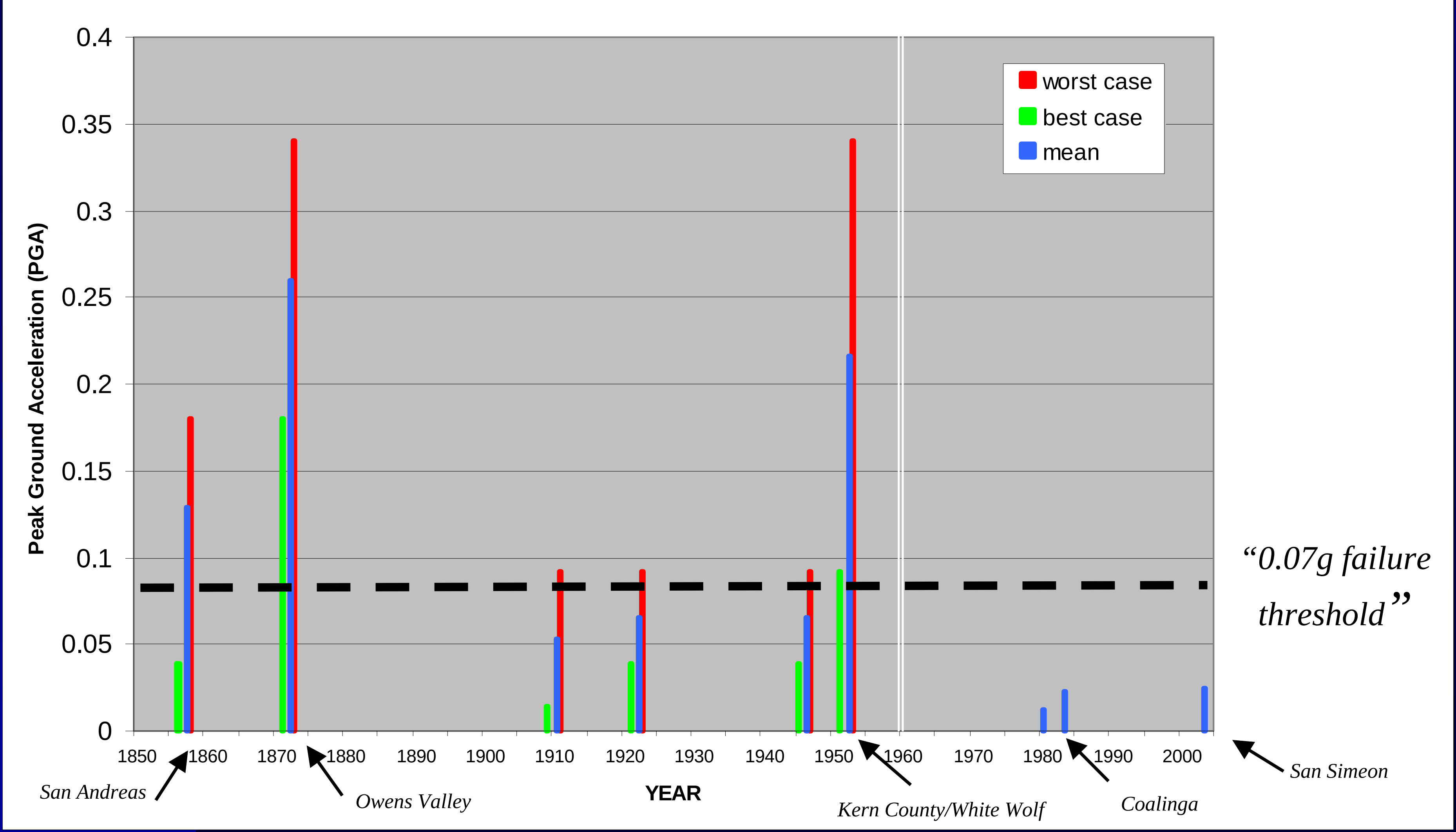
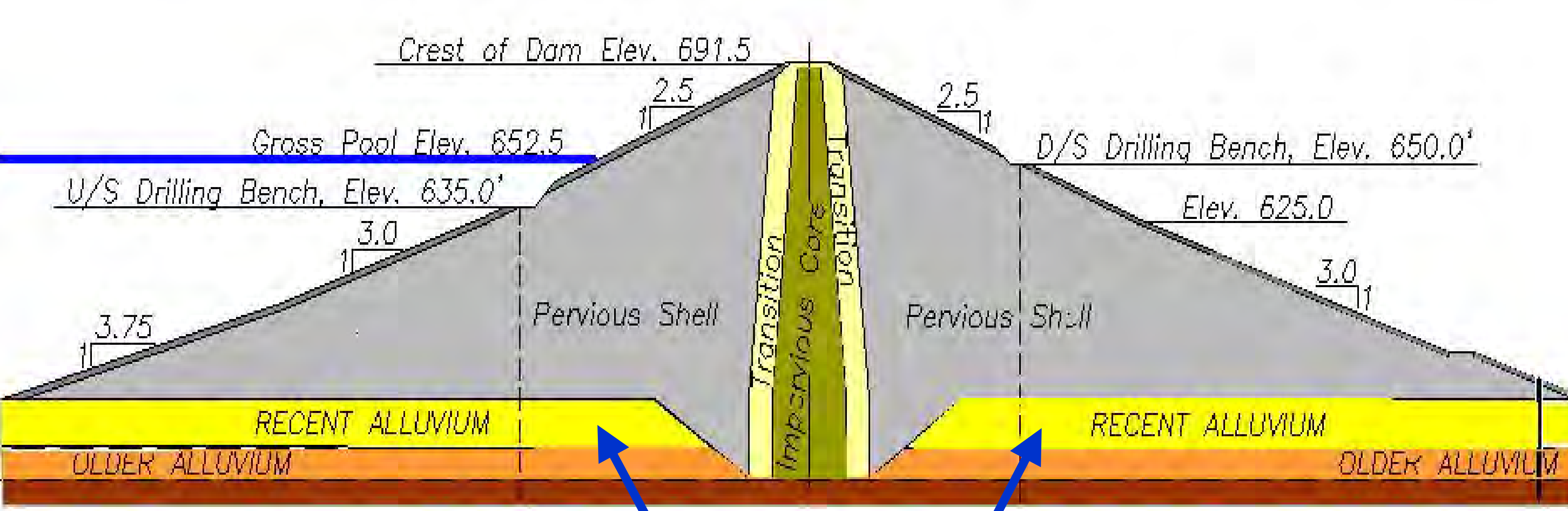
Success Seismic Remediation Project
Historic Earthquakes



Success Seismic Remediation Project
Cross –Section of Dam



Most of the problem materials are the stream deposits known as "Recent Alluvium"

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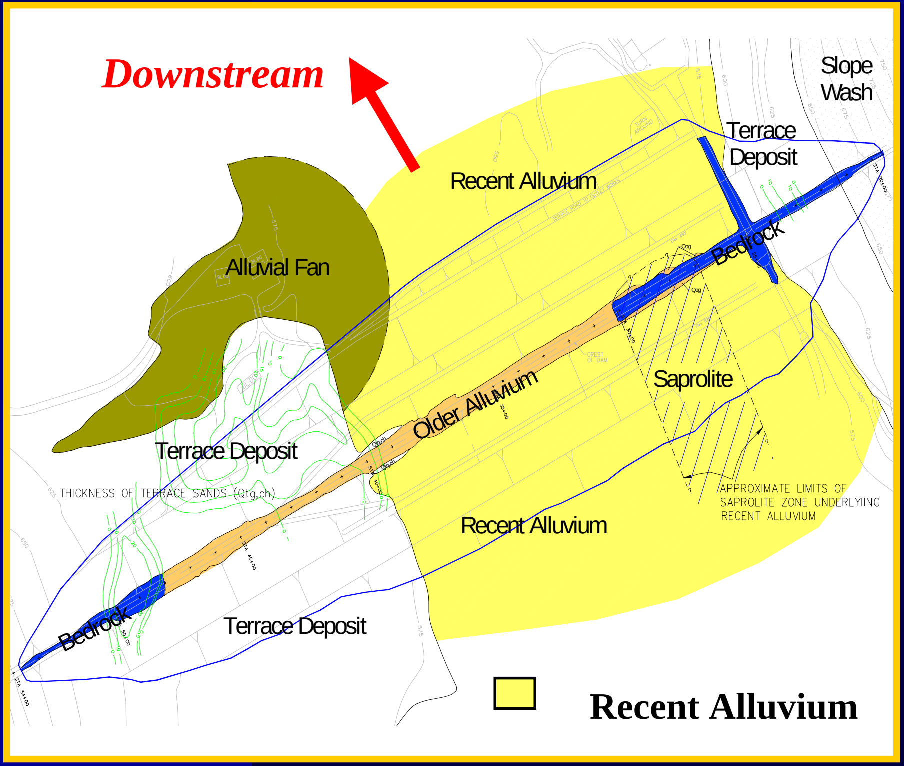
Sacramento District

Success Seismic Remediation Project
Recent Alluvium



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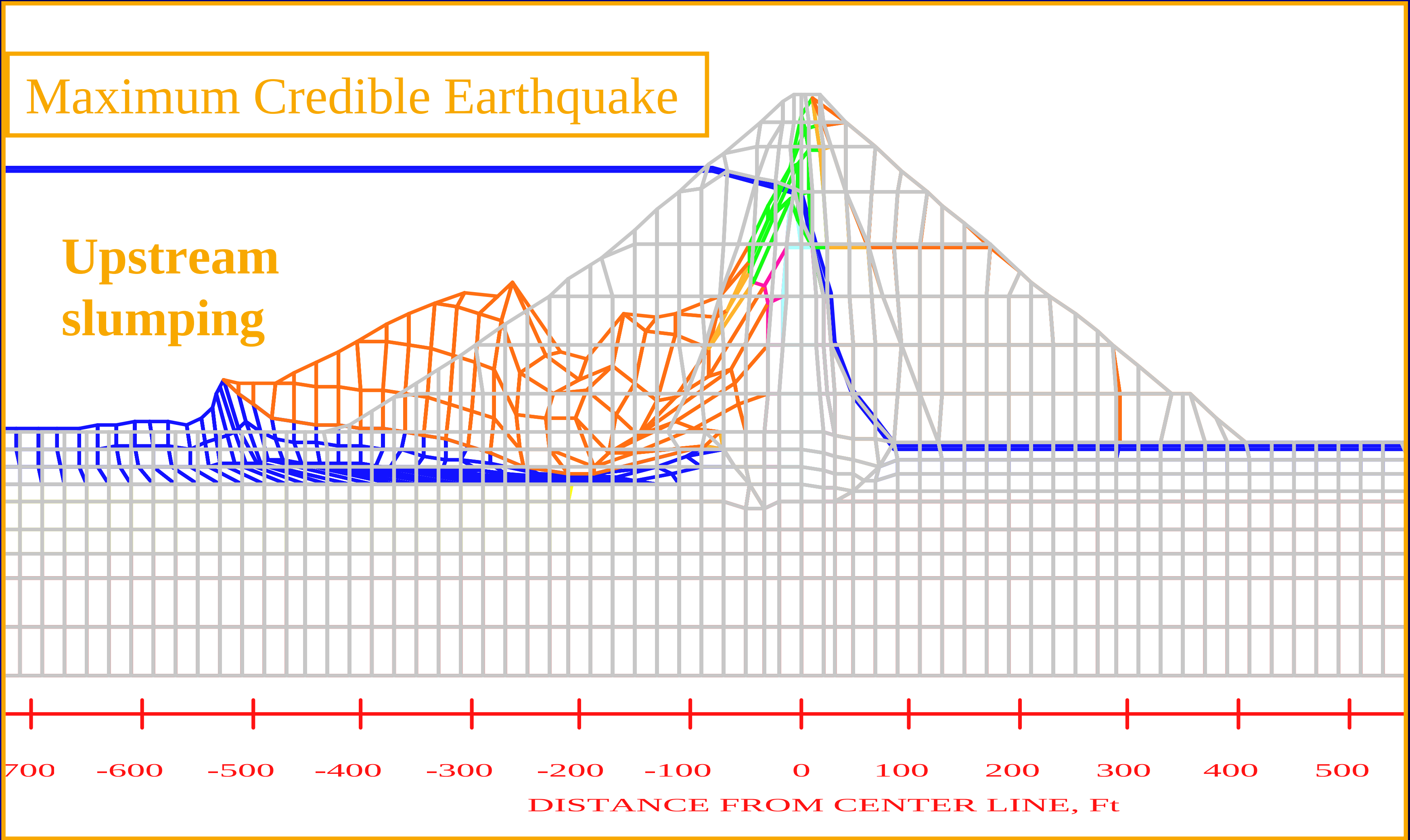
Success Seismic Remediation Project
Dam failure at early stages of MCE



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Sacramento District

Success Seismic Remediation Project
Milestones

- 1999 – Corps completes DSAP Evaluation Report
- 2000 – Construction General Funds appropriated
- 2000-2003 - Further studies and modeling indicate Recent Alluvium will liquefy.
- 2003-2004 - Risk assessment performed
- Sep 2004 – Selection of Roller Compacted Concrete as preferred remediation alternative
- Nov 2004 – CE-SPK Dam Safety Committee recommends temporary operating elevation restriction of 620’ or approximately 1/3 capacity
- Nov 2004 – RCC analysis and studies begin

Success Seismic Remediation Project
Risk Analysis and Operating Restriction

- Risk Analysis Results
  - Risk of uncontrolled release of the reservoir: 1/285 per year. Required 1/10,000
  - Short-term risk reduction: Elevation 620’
    - Eliminates overtopping
    - Reduces seepage failure risk to 1/950
    - Reduces loss of life to within acceptable guidelines
    - May only be in effect for 7 years.
  - Long-term risk reduction requires remediation of dam

Success Seismic Remediation Project
Risk Analysis and Operating Restriction

- Effects of reservoir restriction
  - Loss of Recreation - $2.8M/year (average)
  - Flooding in Tulare Lakebed (wet years = 20%) - $.06M/year (average) - Range $0 - $3.2M
  - Loss of Storage (Agricultural water users) - $1.4M/year (average) - Range $0 - $3.0M

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Success Seismic Remediation Project
Alternative Selection

IN-SITU ALTERNATIVE

OVERLAY ALTERNATIVE

ROLLER COMPACTED CONCRETE ALTERNATIVE

NEW EARTHEN EMBANKMENT ALTERNATIVE

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Success Seismic Remediation Project
Current Status

- RCC Design and Engineering
  - Foundation exploration -75% complete
  - Structural Analysis - 30% complete
  - Environmental Impact Study (EIS) started
  - Quarry Sites – initial testing begun
  - Tower and Conduit analysis started
  - Real Estate Plan started

Success Seismic Remediation Project
Ongoing and Future Contracts

- Sonic drilling for continuous core sample
- 100’ Shaft design and construction
- Concrete coring of inlet tower for seismic analysis
- Initial excavation of quarry site – 200 ton
- Geophysics testing to profile foundation
- Shear wave testing
- Panel of consultants review of RCC decision
- Rock screening and crushing
- Sample existing embankment for materials

Success Seismic Remediation Project
Spillway Enlargement Project

Success Seismic Remediation Project
Spillway Enlargement Project

- PCA signed June 2003
- Non-Federal Sponsors
  - Lower Tule River Irrigation District
  - The Reclamation Board, State of CA
- Estimated cost $28M
- Dual Purpose Project
  - Increase Flood Control from 1:47 to 1:100
  - Increase storage capacity by 29,000 ac-ft
- Work stopped pending further progress on seismic remediation of Success Dam

US Army Corps of Engineers
Sacramento District

Success Seismic Remediation Project
Challenges

- Roller Compacted Concrete Dam
  - Foundation materials inconsistent
  - Cement availability and price stability
- Real Estate Acquisition
  - Real Estate Plan dependent upon EIS
  - Costs of mobile home park relocations
  - Purchase 40-acre parcel before EIS
- Funding
  - Large FY07 and FY08 funding requirements

US Army Corps of Engineers
Sacramento District

Success Seismic Remediation Project
Accelerated Schedule for RCC

Accelerated Schedule	2004	2005	2006	2007	2008	2009	2010	2011
Select Alternative								
Drilling/Exploration Program								
Environmental Impact Study								
AggregateTesting Program								
Seismic Analysis of Dam								
Tower and Conduit Analysis								
Plans and Specifications								
Real Estate Acquisition								
Construction of RCC Dam								
Mitigation								
Funding Requirements ($170M)*		$4M	$8M	$50M	$85M	$18M	$5	
* (does not include new tower or conduit)								

Potential risks due to foundation, tower, conduit

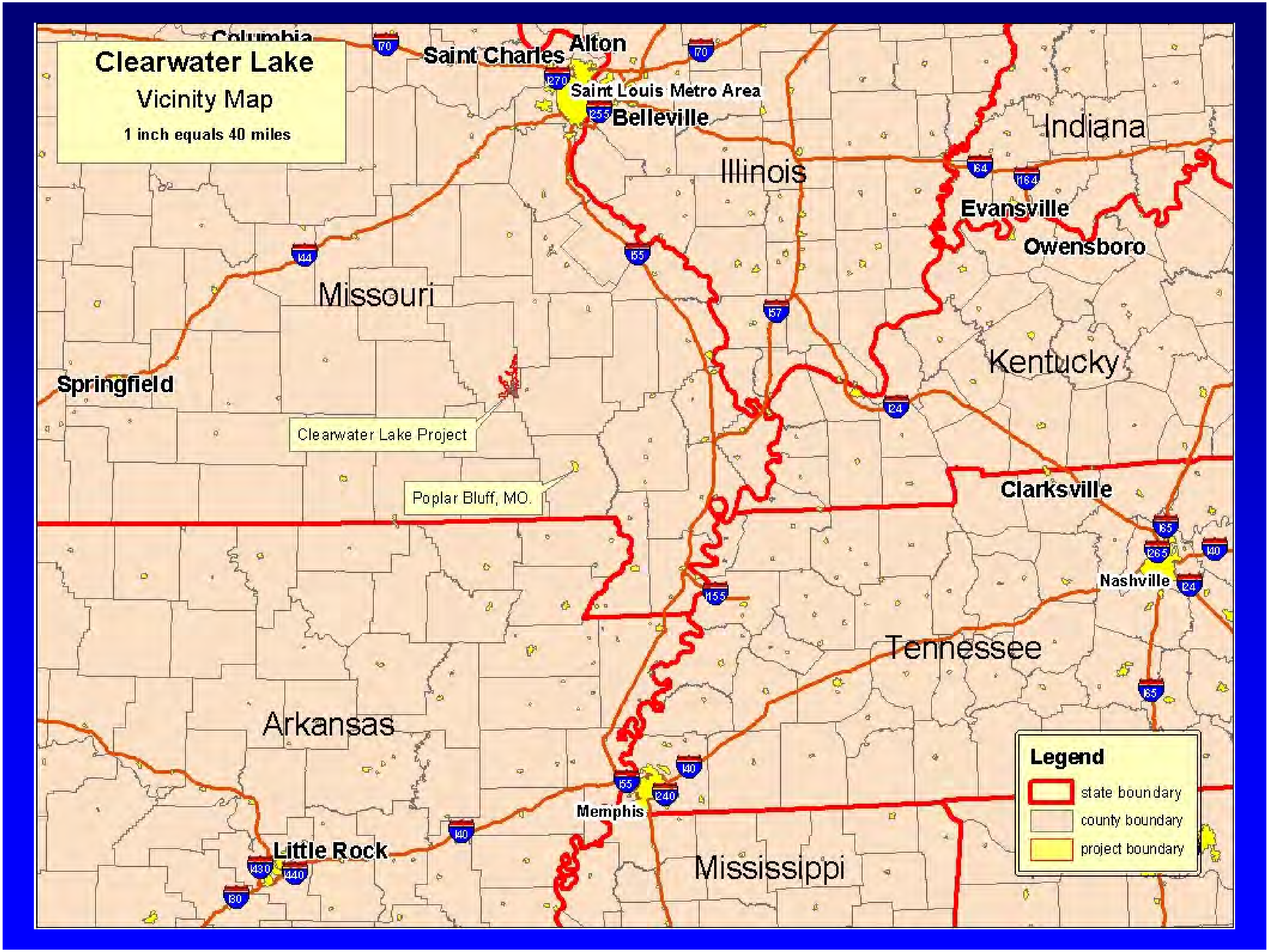
US Army Corps of Engineers
Sacramento District

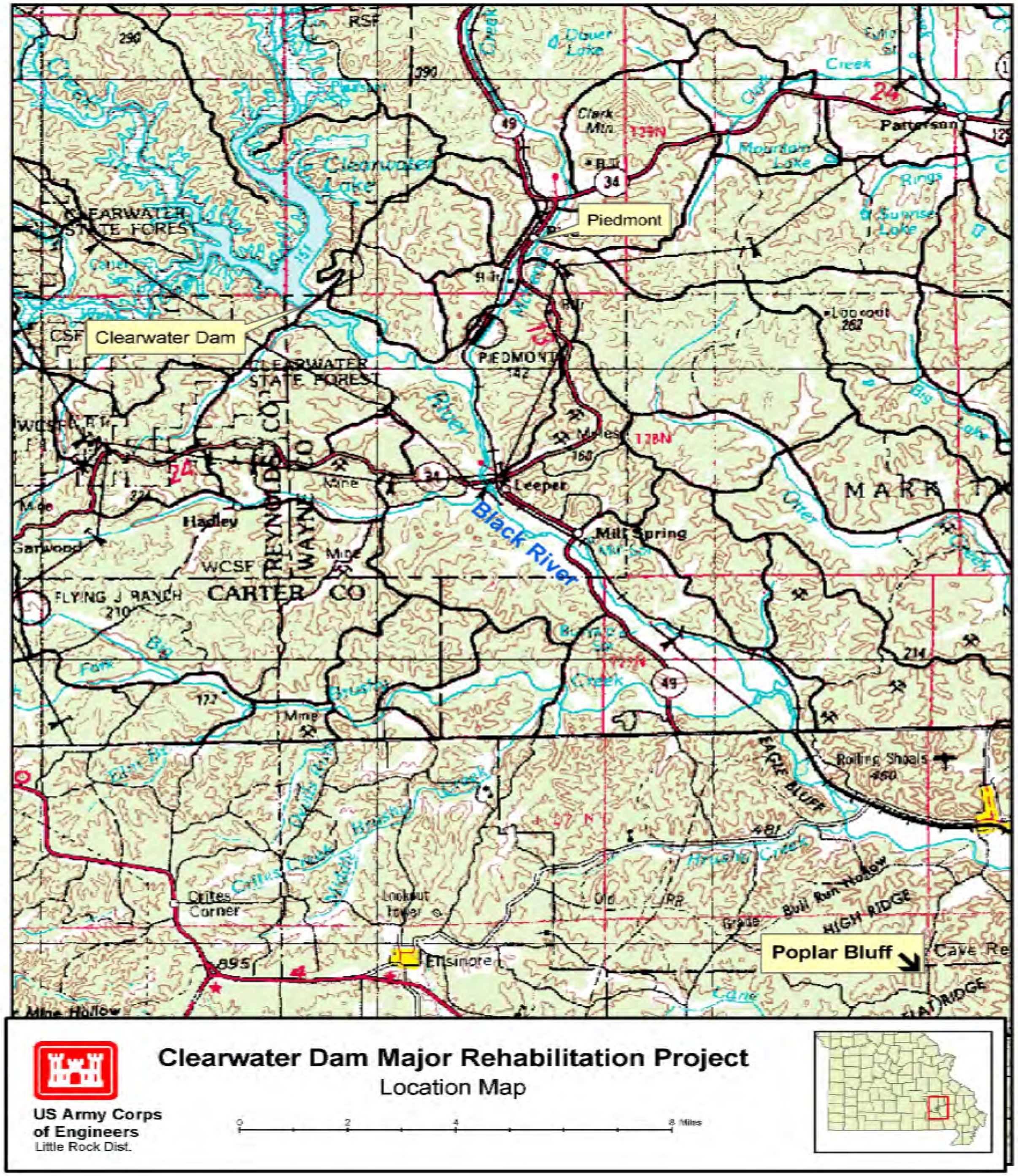
SUCCESS DAM
Questions

Little Rock District

Clearwater Dam
Major Rehab Project

Bobby Van Cleave, P.E.
Geotechnical & Civil Section - Design Branch
Little Rock District Corps of Engineers
✉E-Mail bobby.e.vancleave@swl02.usace.army.mil
☎TEL (501) 324-5055 Ext. 1420
☎FAX (501) 324-5265


Clearwater Lake
Vicinity Map
1 inch equals 40 miles
Columbia
Saint Charles
Alton
Saint Louis Metro Area
Belleville
Indiana
Illinois
Evansville
Owensboro
Missouri
Kentucky
Springfield
Clearwater Lake Project
Poplar Bluff, MO.
Clarksville
Nashville
Tennessee
Arkansas
Memphis
Little Rock
Mississippi
Legend
state boundary
county boundary
project boundary


Piedmont
Clearwater Dam
Poplar Bluff
Clearwater Lake
Black River
CARTER CO
REYNOLDS CO
WAYNE CO
PIEDMONT
Leeper
Mill Spring
Hadley
Ellsinore
Crites Corner
Patterson
Clearwater Dam Major Rehabilitation Project
Location Map
US Army Corps of Engineers
Little Rock Dist.
0
2
4
8 Miles

CLEARWATER LAKE - MISSOURI

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What’s the problem(s)?

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Significant Deficiencies

- Long-Term Seepage
  - Seepage has been observed at and around the downstream left abutment since first filling.
  - Several remediation attempts have been accomplished over the past 60 years.
  - A sinkhole appeared on the upstream face of the embankment in 2003.
- Seismic
  - Clearwater is located in the New Madrid Seismic Zone.
  - Some of the alluvial soils beneath the structure may be susceptible to liquifaction under certain earthquake events.
- Spillway
  - There is currently material located within the spillway that should be removed to allow for the PMF event.

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What can happen?

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Consequences

- In the event of a dam breach caused by seepage or seismic
  - Total damages: $168,520,000
  - Total loss of life: 340

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When were seepage problems first observed?

Original Construction – STA 41+68

Looking E from 150' U.S. of station 41 ≠ 68: General view of cut-off trench operations.

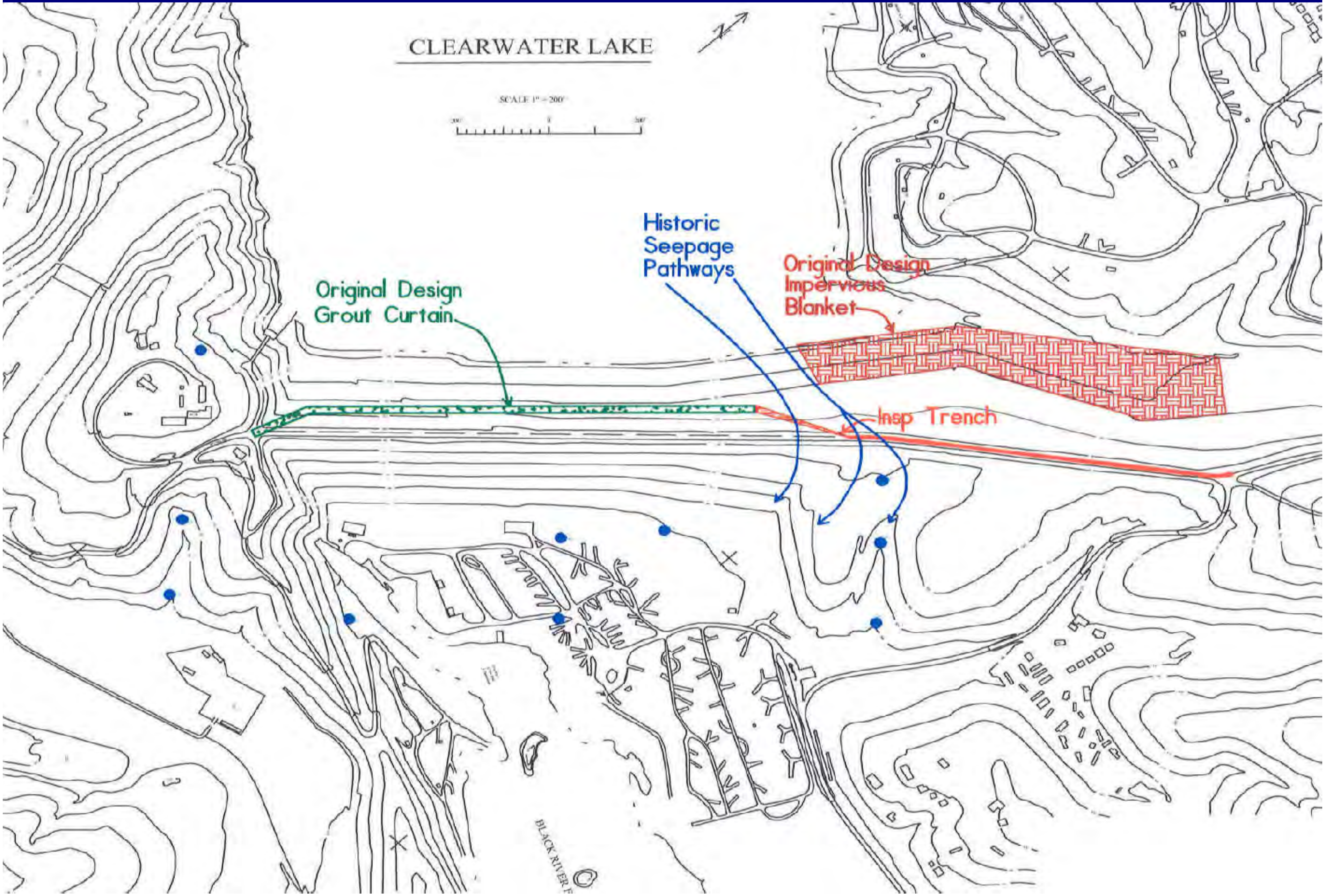
Original Construction – STA 39+20

Looking S from 175' US of station 39 + 20: Open joint in cut-off trench foundation.

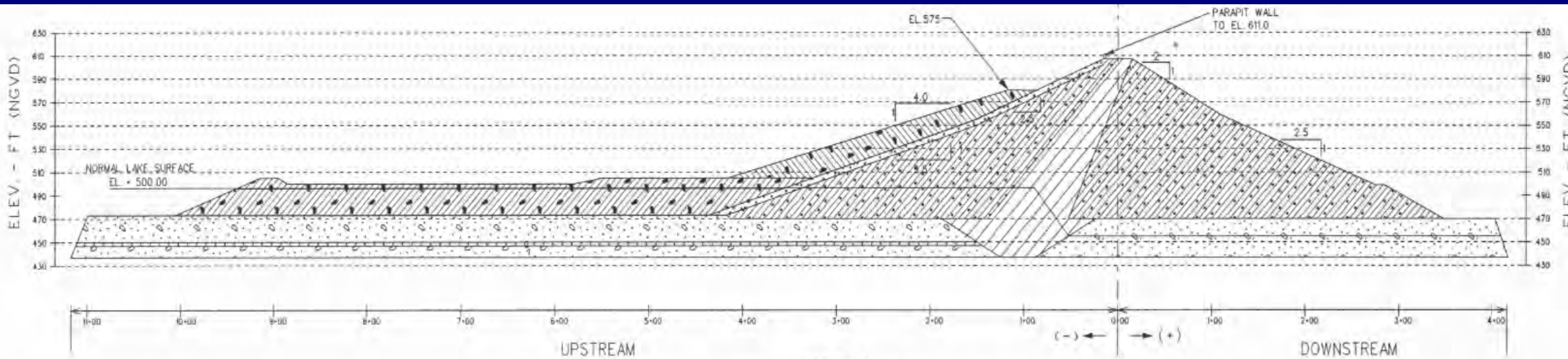
Original Construction – STA 40+15

Looking NW from 35' U.S. of station 40 + 15: Open joint in cut-off trench foundation.

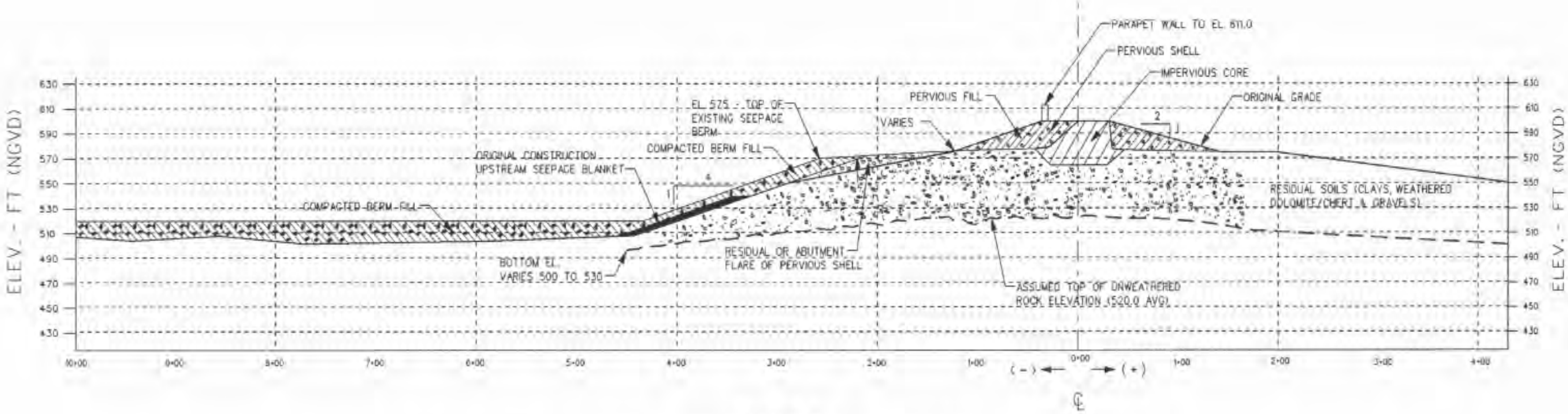
ORIGINAL DESIGN



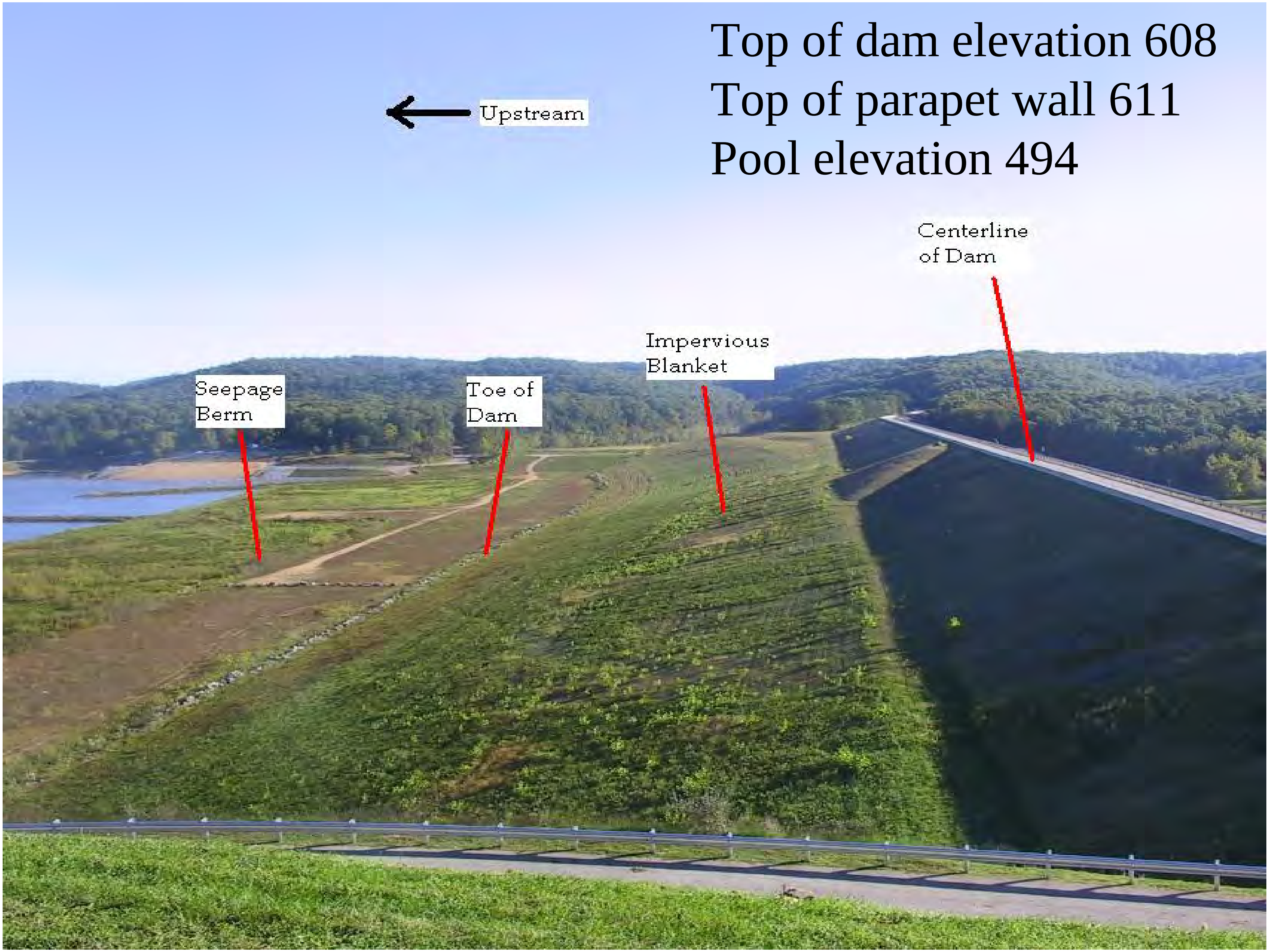
EXISTING STRUCTURE



SECTION A
TYPICAL EXISTING SECTION - NEAR CENTER OF DAM
(STATIONS 33 TO 55 +/-)
(SCALE: AS SHOWN)



SECTION B
TYPICAL EXISTING SECTION NEAR LEFT ABUTMENT
(STATIONS 15 TO 33 +/-)
(SCALE: AS SHOWN)


Top of dam elevation 608
Top of parapet wall 611
Pool elevation 494
Upstream
Centerline of Dam
Impervious Blanket
Seepage Berm
Toe of Dam

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CLEARWATER DAM
POOL OF RECORD – MAY 2002
ELEVATION 566.7

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POOL OF RECORD – MAY 2002
LOOKING TOWARDS LEFT ABUTMENT

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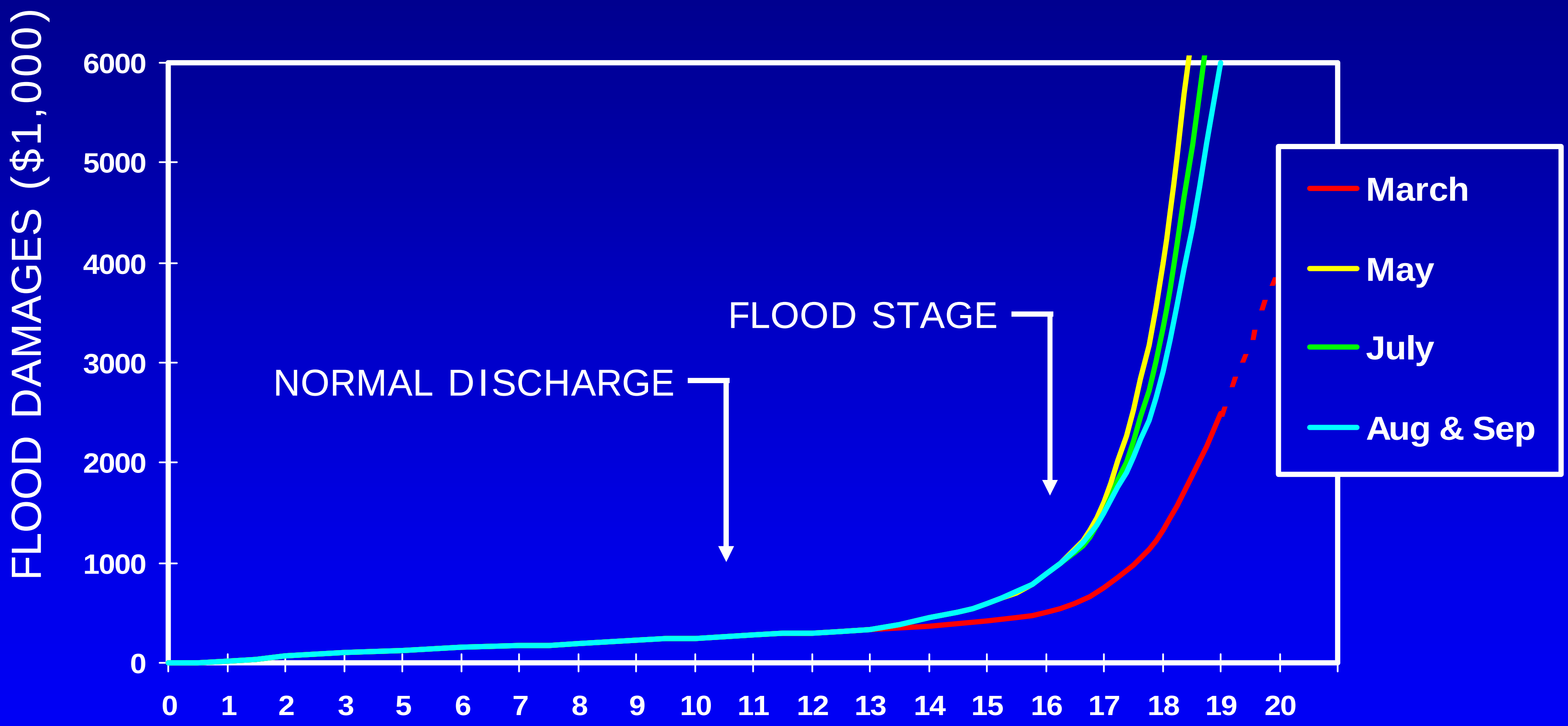
POOL OF RECORD – MAY 2002 EMERGENCY SPILLWAY LOOKING TOWARDS NORTHEAST

CLEARWATER DAM DISCHARGE IMPACTS



Black River Stage @ Popular Bluff, MO (ft.)

Clearwater Dam – Sinkhole Investigation
15 January 2003


Legend
sinkhole


Clearwater Dam – Sinkhole Investigation
16 January 2003


Clearwater Dam – Sinkhole Investigation
16 January 2003

Final excavation at 25 feet deep

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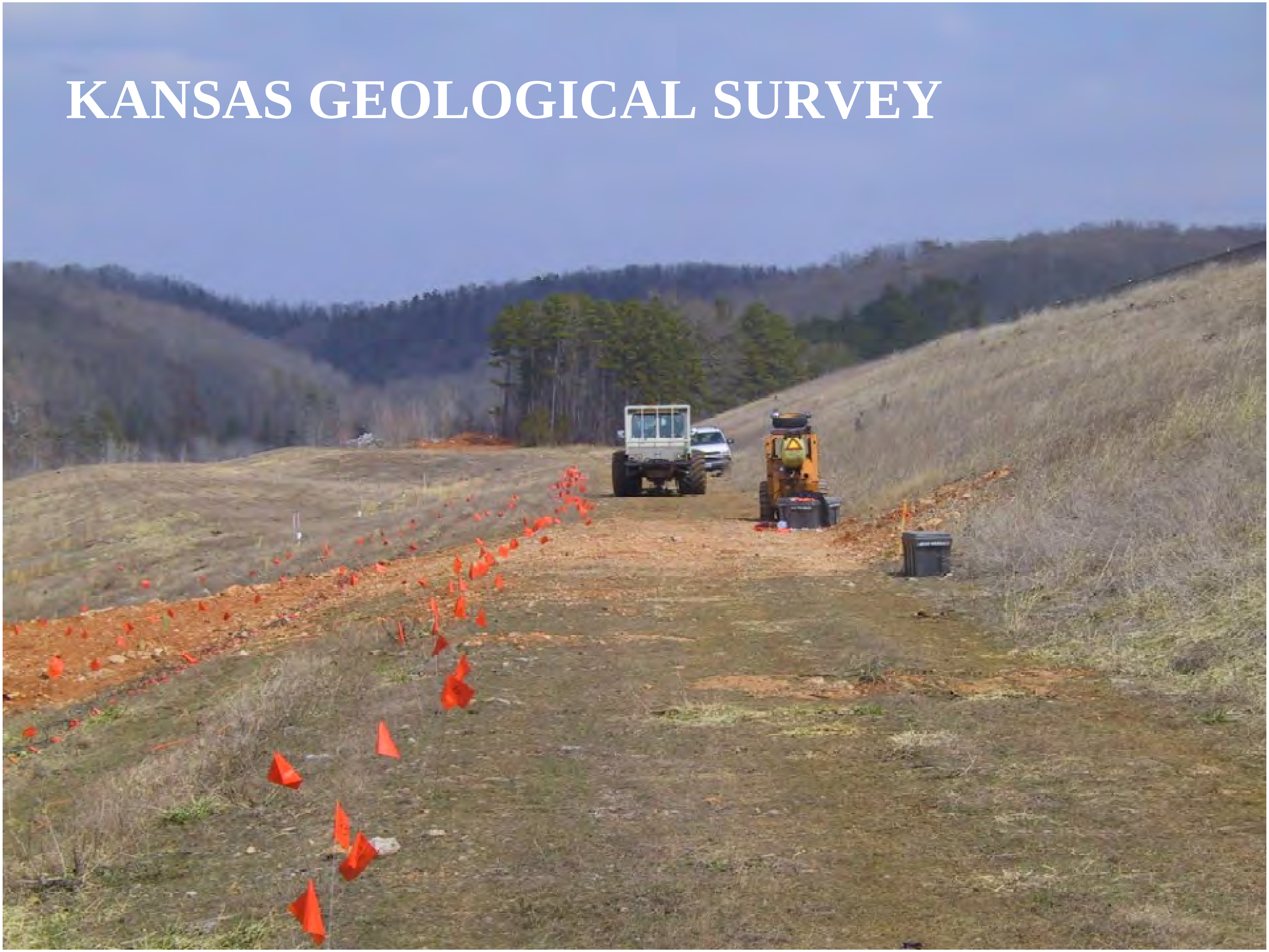
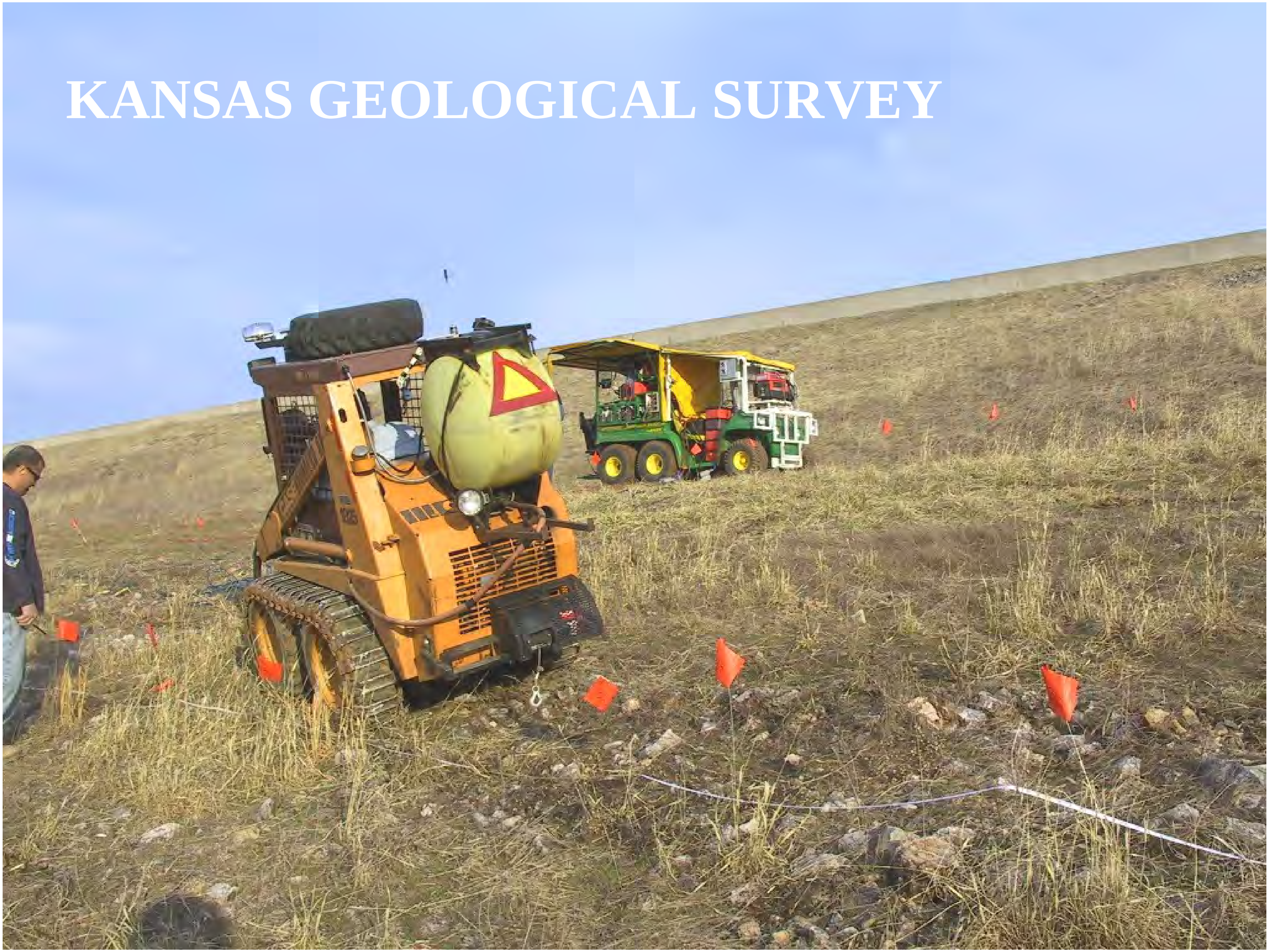
Geophysical and Subsurface Investigations

- Kansas Geological Survey – surface wave, reflection
- Sonic Drilling – 6 borings, 50’ into rock
- Bureau of Reclamation – crosshole tomography
- ERDC – SP, EM conductivity, ER


KANSAS GEOLOGICAL SURVEY


KANSAS GEOLOGICAL SURVEY

Sonic drilling – Clearwater Dam – 8 April 2003


1' of concrete below impervious core
Sinkhole boring SH-1A
9 April 2003

Bureau of Reclamation – June 2003

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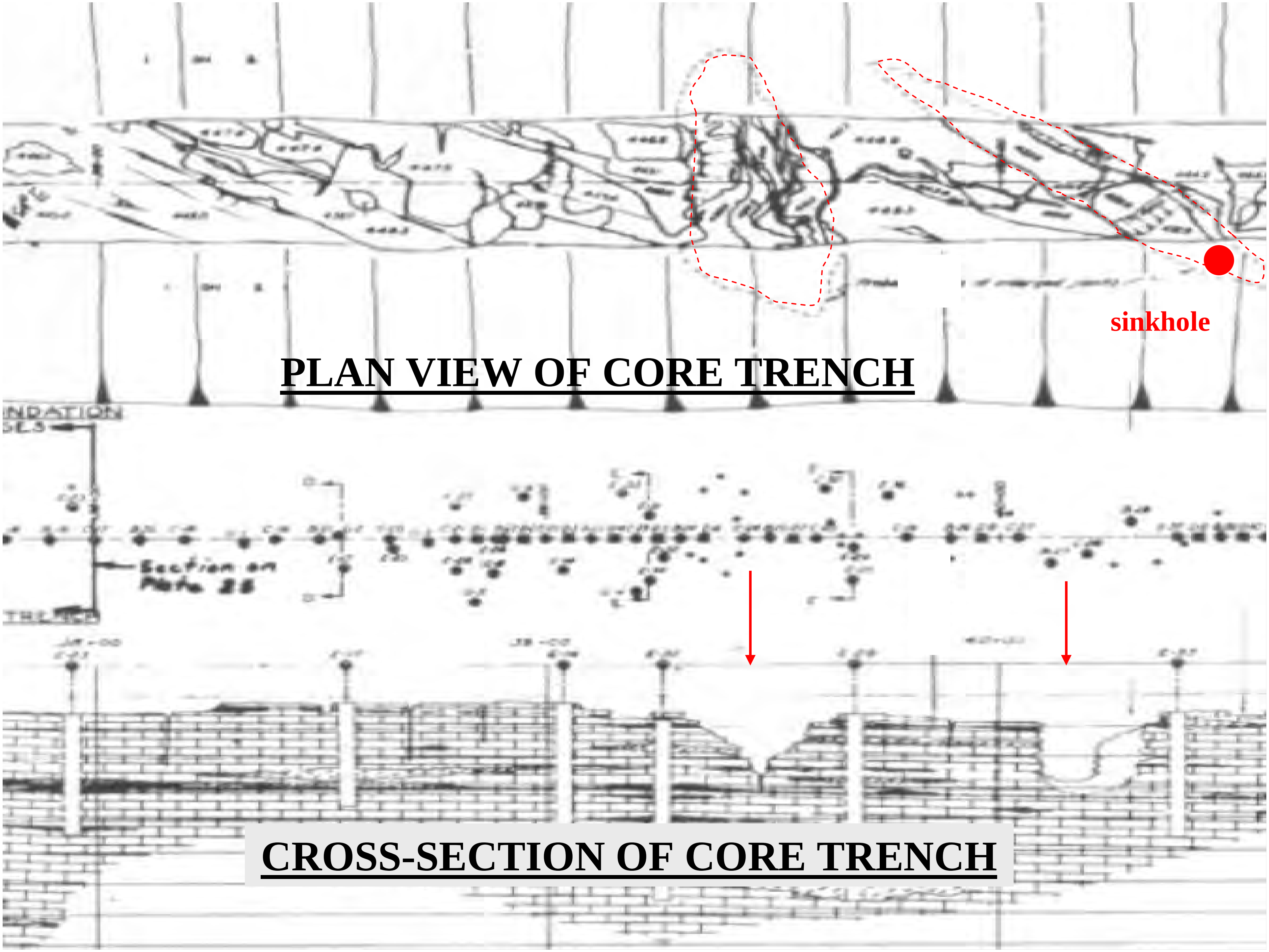
What information was gained from these investigations?


sinkhole
PLAN VIEW OF CORE TRENCH
CROSS-SECTION OF CORE TRENCH

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MAJOR REHAB PROJECT SUMMARY

- PDT arrived at two primary structural alternatives (out of 10 measures evaluated) that address the Clearwater seepage problems.
- Report submitted June 04.
- Approved by SWD 6 August 04.
- Receive CG Wedge Funds from HQ 13 Aug 04.

Little Rock District

MAJOR REHAB PROJECT SUMMARY

- Design/Const schedule developed Oct 04
- New survey initiated in Oct 04, complete Feb 05
- Seepage consultants on board Feb 05
  - Bruce, Silva, Poulos
- Cutoff wall through the centerline of the dam was approved. Wall location has been moved to centerline of clay core by SWL and Consultants with approval by SWD and HQ.

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What immediate remediation efforts need to be performed?

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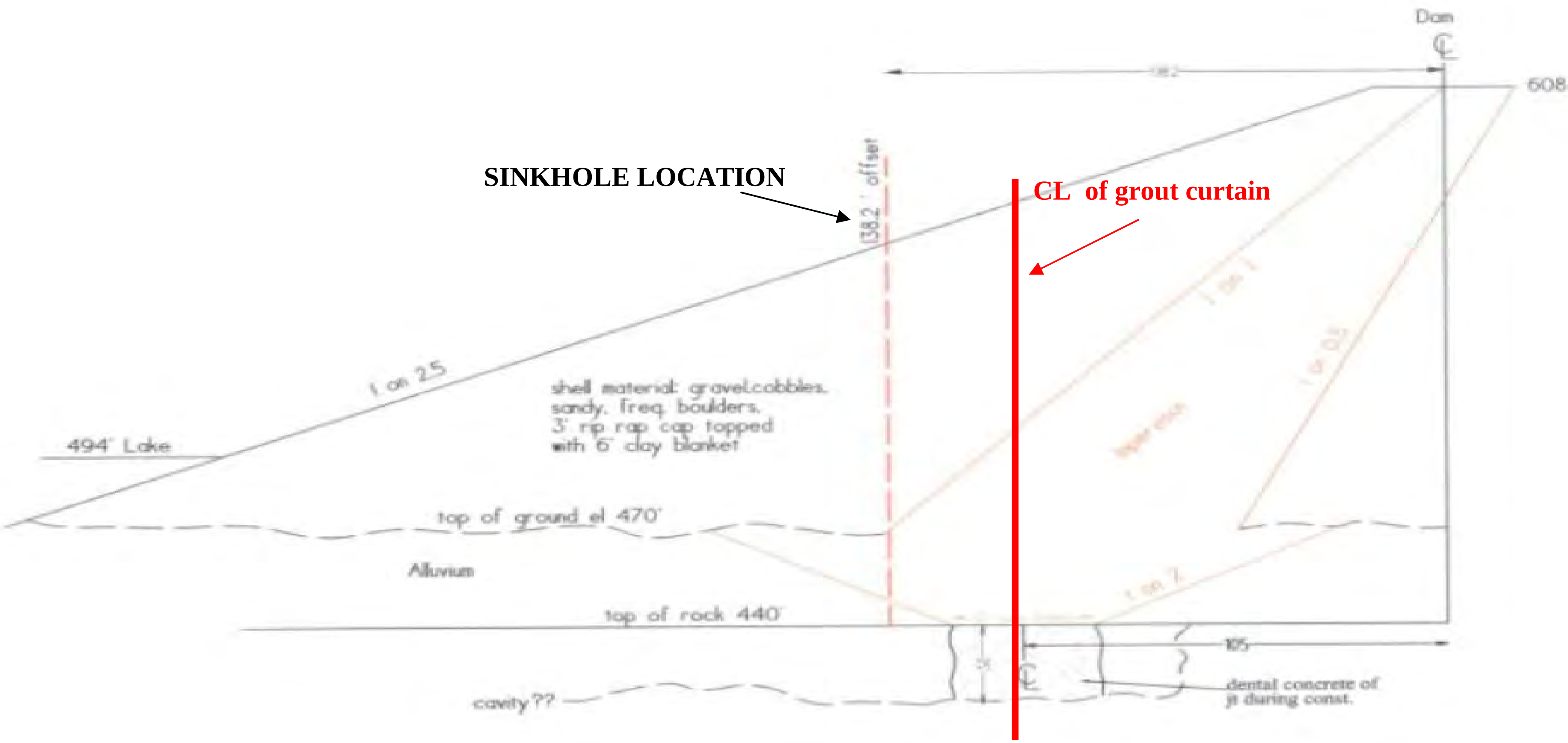
Foundation Drilling and Grouting – Sinkhole Repair Project

Location of Sinkhole and Grouting Project

Little Rock District

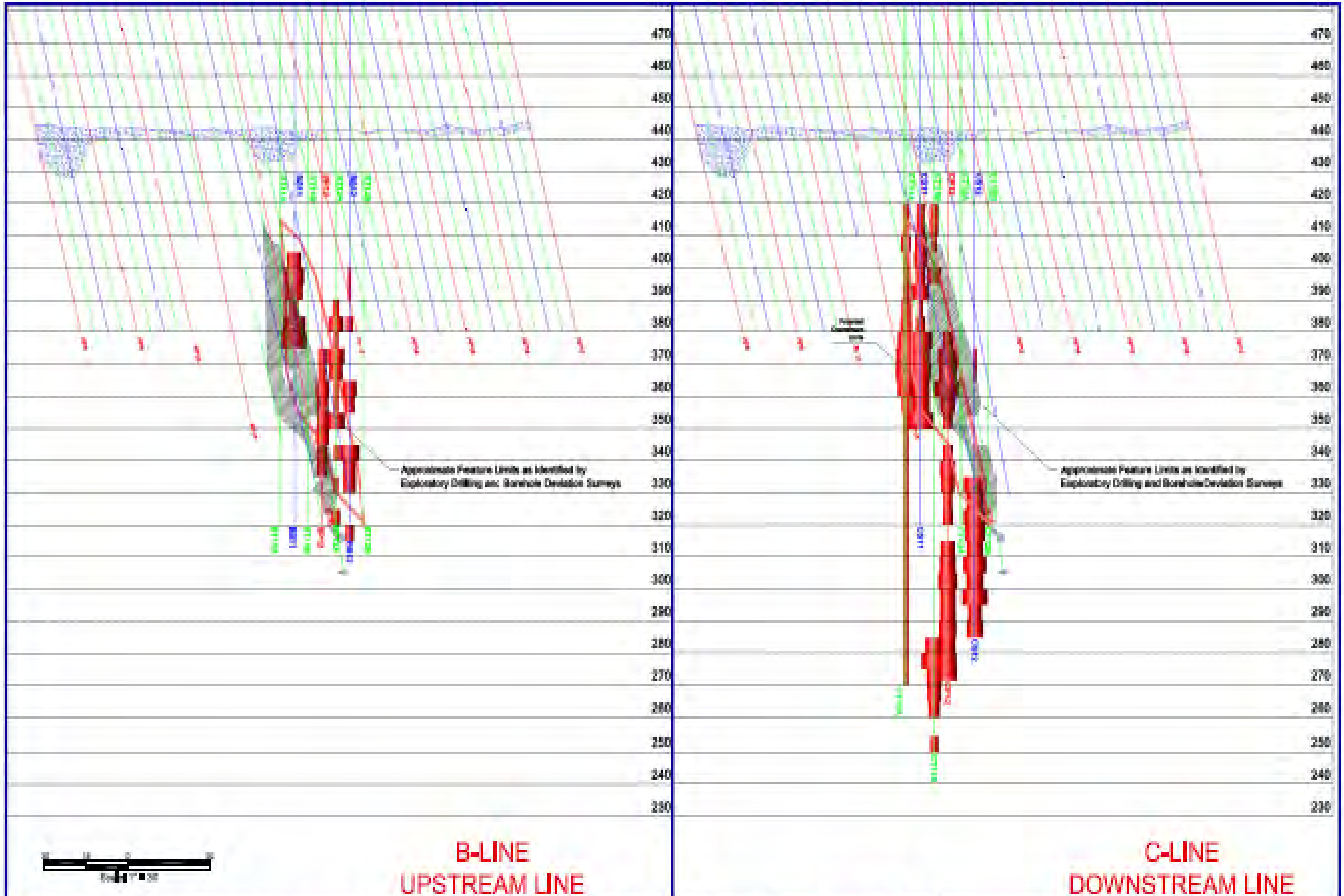
Clearwater Dam

Embankment Cross Section



Clearwater Dam – Sonic Drilling

Clearwater Dam – Grout Line



ADVANCED CONSTRUCTION TECHNIQUES LTD.
MAPLE, ONTARIO

GANNETT FLEMING INC.
HARRISBURG, PENNSYLVANIA

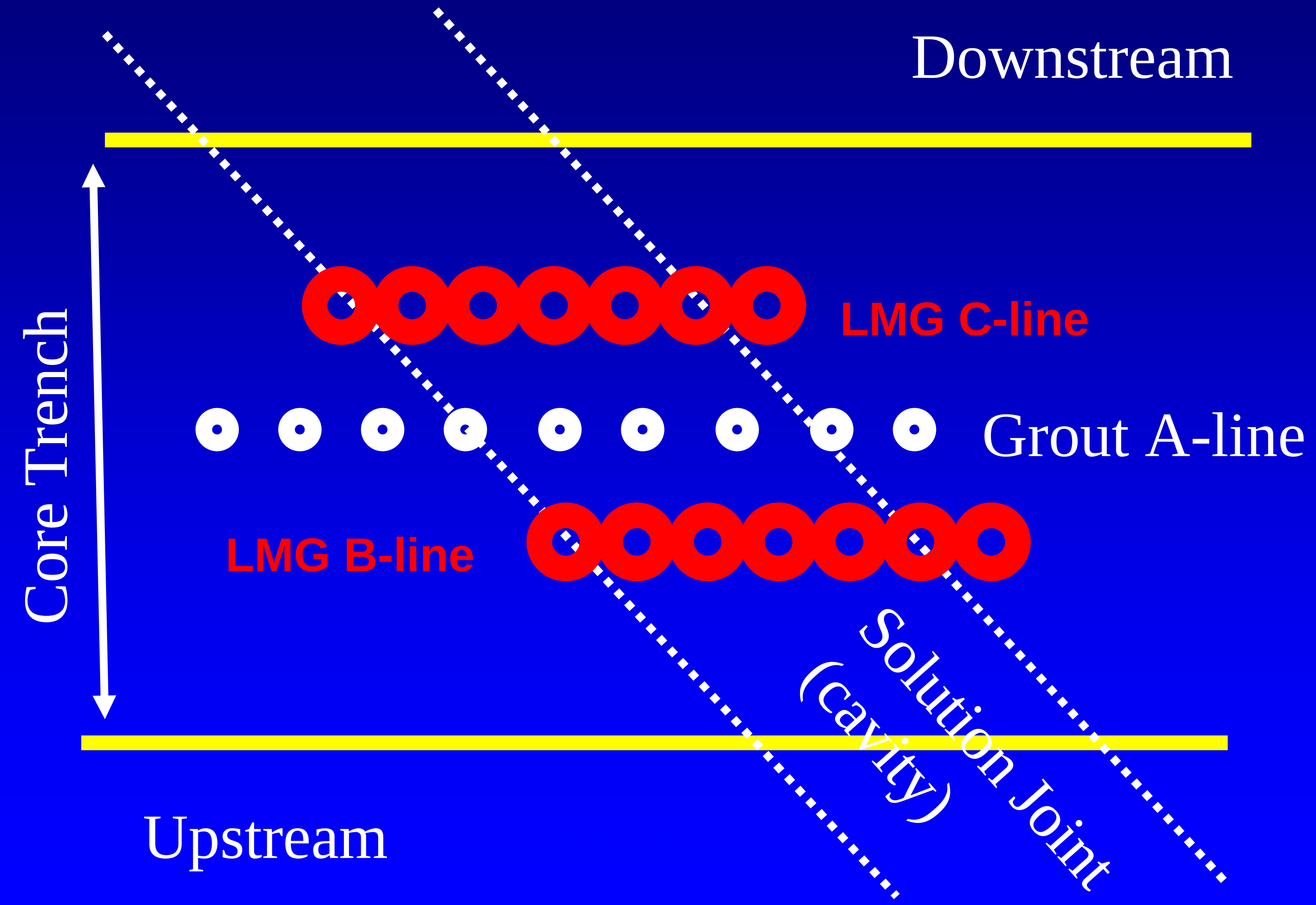
IntelliGrout™
The Science of Grouting

CLEARWATER DAM SINKHOLE REPAIR
PIEDMONT, MISSOURI
FOUNDATION DRILLING AND GROUTING
CONTRACT NO.: W9127S-04-C-0003

US Army Corps of Engineers

FIGURE 3
PROFILE VIEW OF LMG HOLES
Updated as of 3-15-05

LOW MOBILITY GROUT HOLES – PLAN VIEW



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FY 04-05 Grouting Contract Summary

- November 2003 – ACT/Gannett-Fleming
- December 2003 – NTP
- April 2004 – grouting began in rock
- August 2004 – grouting 75% complete; discovery of unknown cavity
- November 2004 – modify contract for low mobility grout (LMG)
- April 2005 – complete LMG
- May 2005 – contractor demob

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Will seismic issues affect seepage remediation?

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SEISMIC STUDY EFFORTS

- Hired FMSM to perform parametric seismic analysis.
- Obtained services of seismic consultants – Seed, Castro, Lorig, Hempen.
- Performed additional SPT for limited seismic investigation requested by consultants to verify historical drilling data.

Drilling and Sampling Photos

Instrumented Drill Rod to Measure Hammer Energy

Drilling and Sampling Photos

SPT Analyzer Readout Terminal

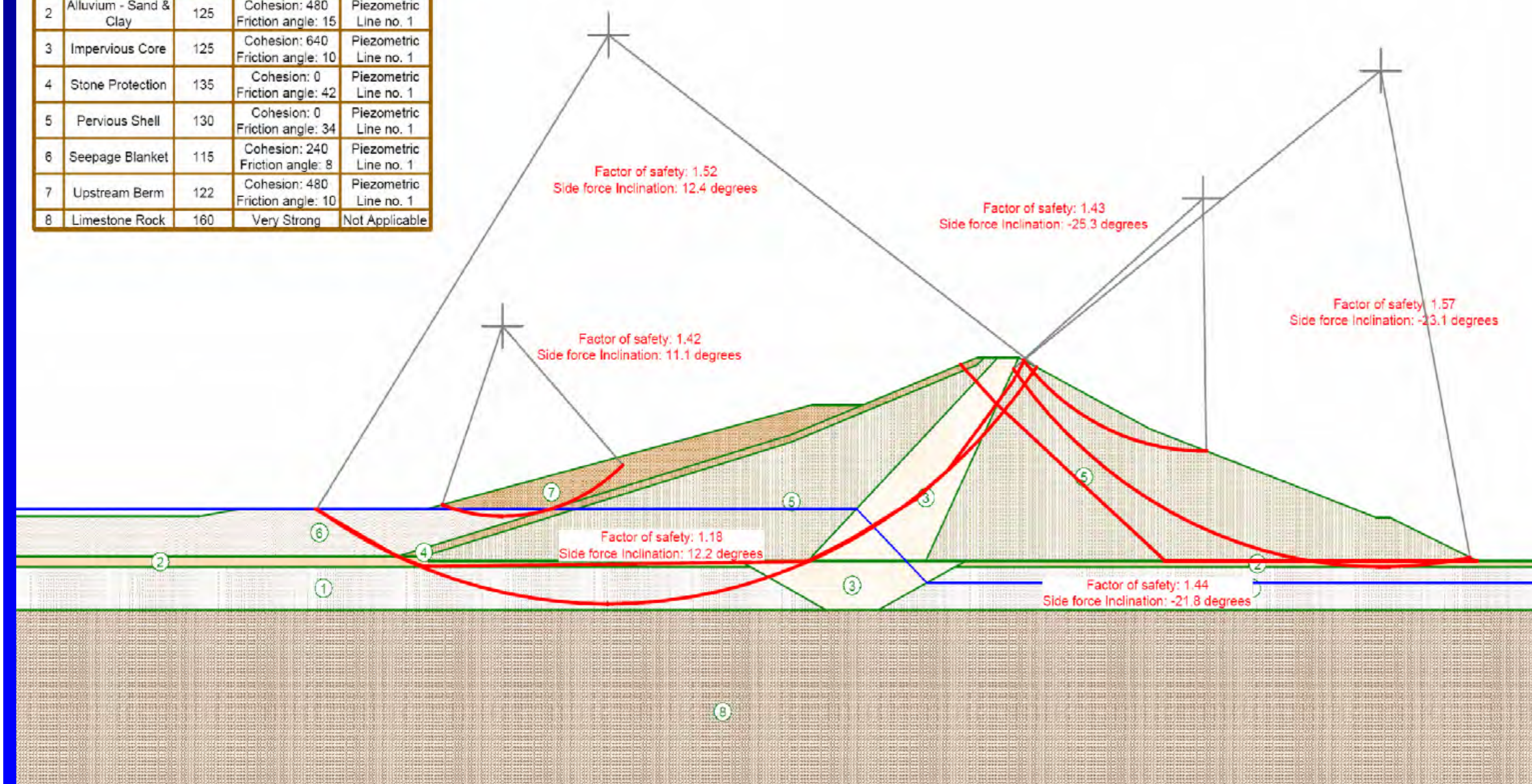
Drilling and Sampling Photos

Disturbed Tube Sample

Little Rock District

Pseudostatic Analyses with UTEXAS4

NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	Alluvium - Sand & Gravel	132	Cohesion: 0 Friction angle: 27	Piezometric Line no. 1
2	Alluvium - Sand & Clay	125	Cohesion: 480 Friction angle: 15	Piezometric Line no. 1
3	Impervious Core	125	Cohesion: 640 Friction angle: 10	Piezometric Line no. 1
4	Stone Protection	135	Cohesion: 0 Friction angle: 42	Piezometric Line no. 1
5	Pervious Shell	130	Cohesion: 0 Friction angle: 34	Piezometric Line no. 1
6	Seepage Blanket	115	Cohesion: 240 Friction angle: 8	Piezometric Line no. 1
7	Upstream Berm	122	Cohesion: 480 Friction angle: 10	Piezometric Line no. 1
8	Limestone Rock	160	Very Strong	Not Applicable



SEISMIC STUDY SUMMARY

Little Rock District

- Slope stability and FLAC analyses indicate no slope failure under current OBE assigned by ERDC.
- SPT samples were relatively consistent with historical data.
- The cutoff wall should incorporate a plastic concrete to match the strengths of the embankment materials.
- FMSM to finalize data and report in July.
- Continue seismic analysis through DSAP (FY06-FY08).

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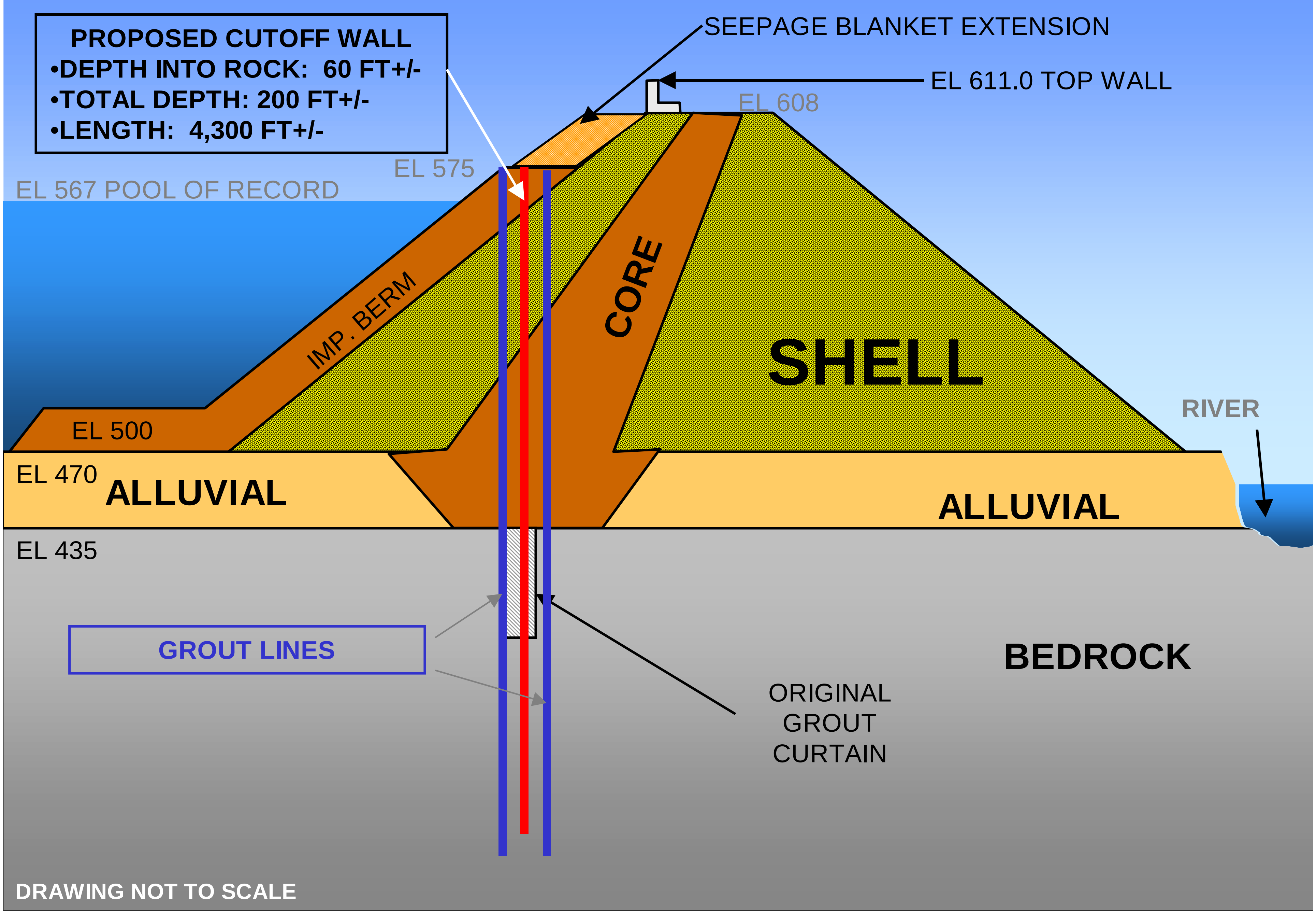
MAJOR REHAB PROJECT STATUS

- Phase I –exploratory drilling/grouting along full length of dam. (early FY06)
- Phase II – construction of work platform, Cutoff wall construction and seepage blanket extension. (late FY06)

CUTOFF WALL PROJECT



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CRITICAL INFORMATION NEEDED FOR CUTOFF WALL DESIGN

- Depth of rock embedment.
- Permeability of existing soils and rock.
- Method of construction:
  - Rock mill or Secant pile
- The presence of any other large cavities/features.

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MAJOR REHAB AND DAM SAFETY PROJECT FUNDING

- FY05
  - **$1.05M CG**– detailed design for MRP
  - Per direction from HQ/SWD, utilized $350k for limited seismic deformation and stability analysis
- FY06
  - **$22M CG** – Phase I construction (exploratory drilling/grouting)
  - Complete design and initiate Phase II construction (work platform, cutoff wall)
  - **$245k** O&M – Seismic Intensity for MCE, Borings and Testing
- FY07
  - **$23M** CG – Phase II construction (work platform, cutoff wall)
  - **$260k** O&M – Seismic Analysis Phase I and II

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MAJOR REHAB AND DAM SAFETY PROJECT FUNDING

- FY08
  - **$23M** CG – Phase II construction (cutoff wall)
  - **$300k** O&M – Seismic Evaluation Report
- FY09
  - **$21.1M** CG – Phase II construction (cutoff wall)
- FY10
  - **$23M** CG – Phase II construction (work platform, cutoff wall)

Little Rock

District

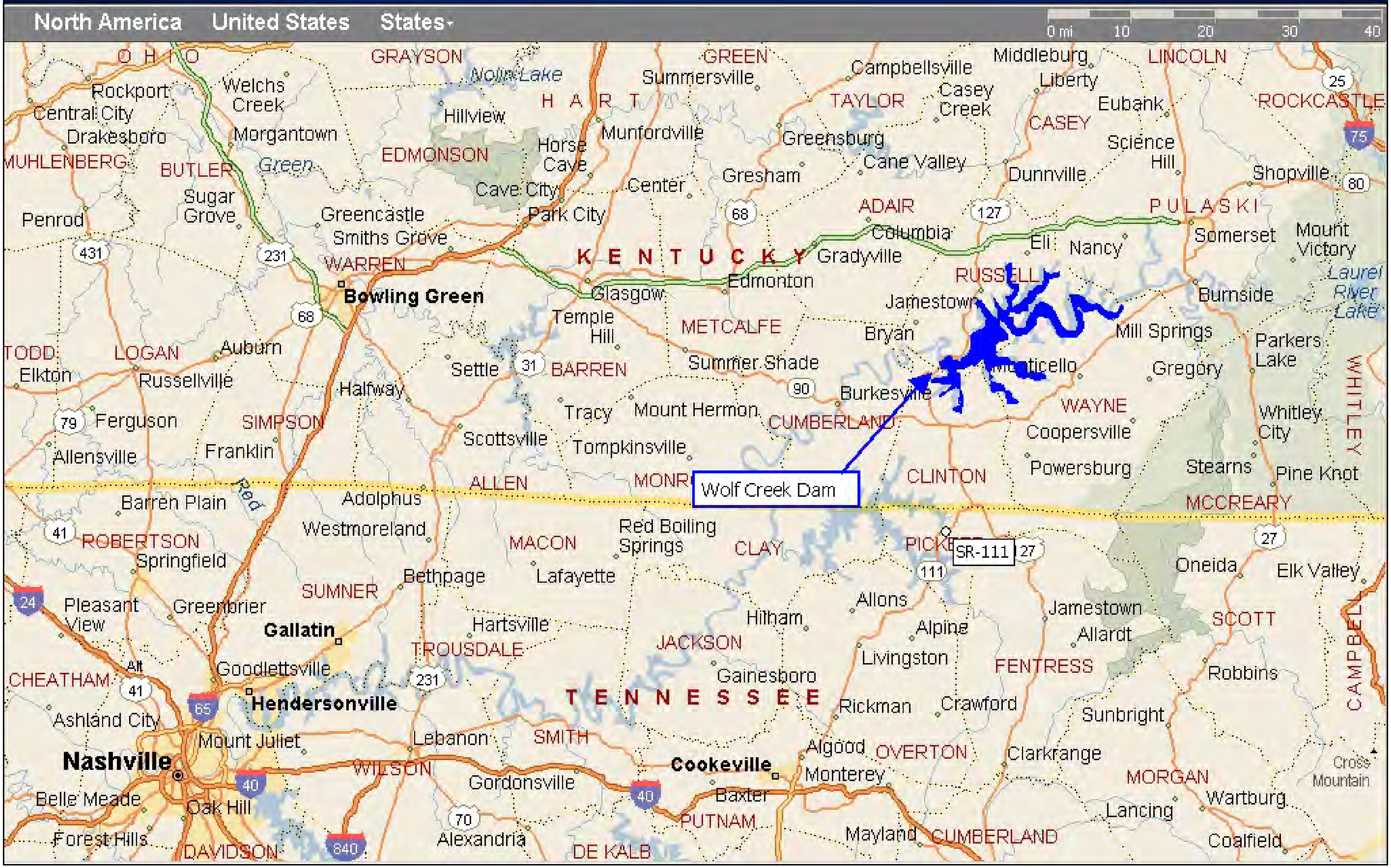
Wolf Creek Dam Seepage Major Rehabilitation Evaluation

US Army Corps of Engineers, Nashville District

Outline of Topics

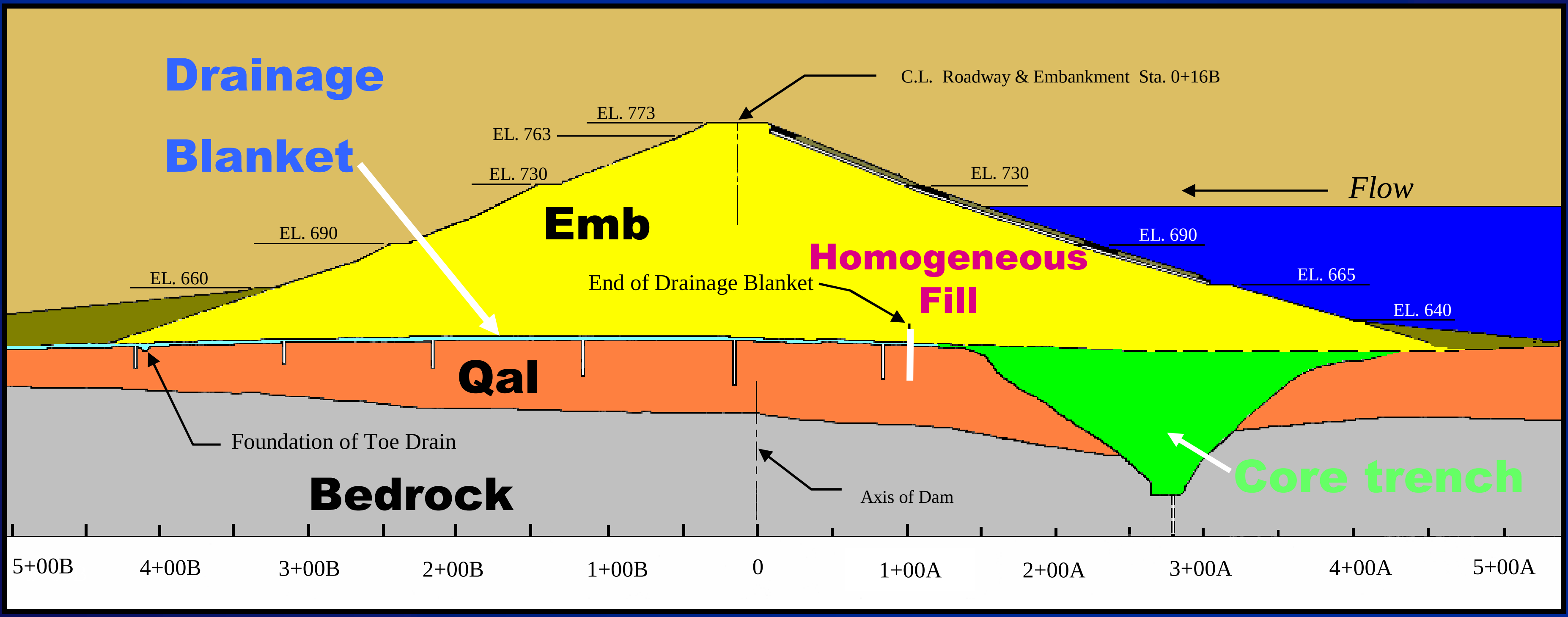
- Project Features
- Foundation Problems
- 1960's Distress Indicators and Actions
- Post Wall Performance/Current Distress Indicators
- Proposed Remedy

Project Location

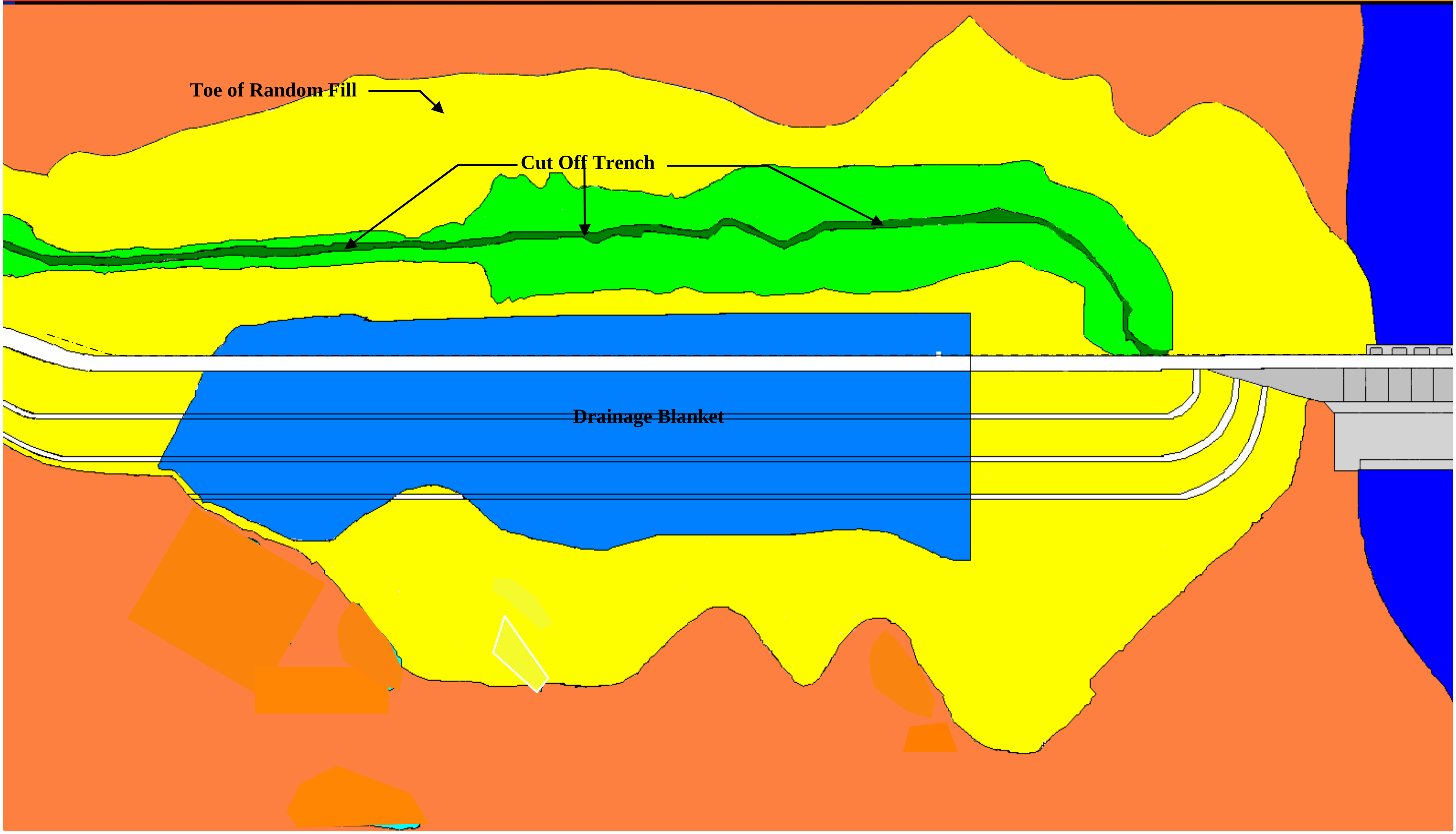


Project Features

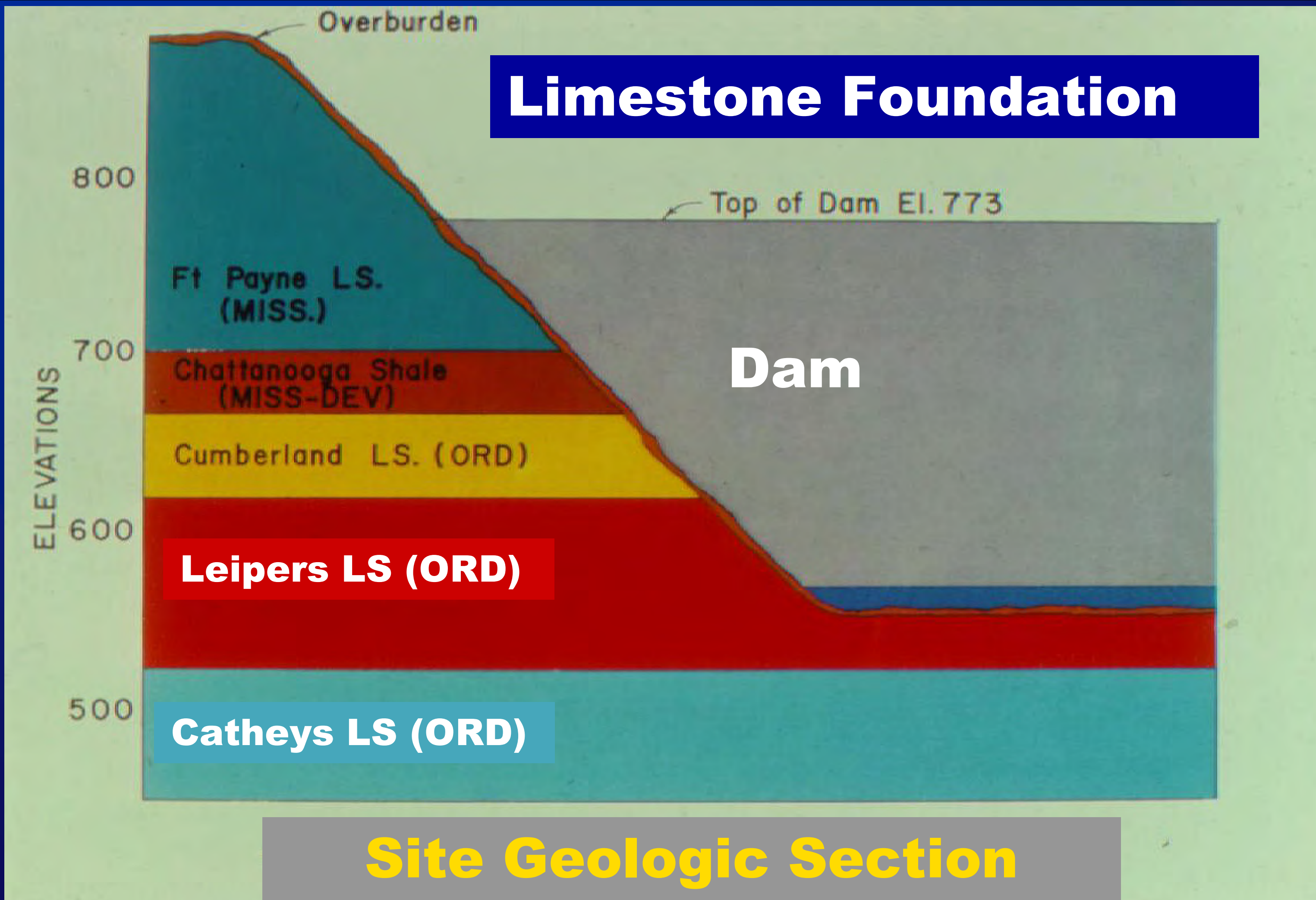
EMBANKMENT SECTION STA. 44+50L



EMBANKMENT PLAN



Geology


Limestone Foundation
Overburden
Top of Dam El. 773
800
700
600
500
ELEVATIONS
Ft Payne LS.
(MISS.)
Chattanooga Shale
(MISS-DEV)
Cumberland LS. (ORD)
Dam
Leipers LS (ORD)
Catheys LS (ORD)
Site Geologic Section

Foundation Treatment Problems

- Treatment techniques inadequate for this geology
- Most of the alluvium left in place
- Except for cut-off trench, no embankment foundation treatment
- Cutoff trench design and construction inadequate

I-A, -B, and -D. The bottom of this section of trench, at this stage of excavation, is still in overburden except for a few narrow areas where the rock salients showing in the overburden slopes were connected across the trench line. It is proposed to excavate the floor of the trench to continuous sound rock for the grout curtain. Overhangs and loose rock

8-2[illegible]-42. Facing SE in trench from sta. 5+50.

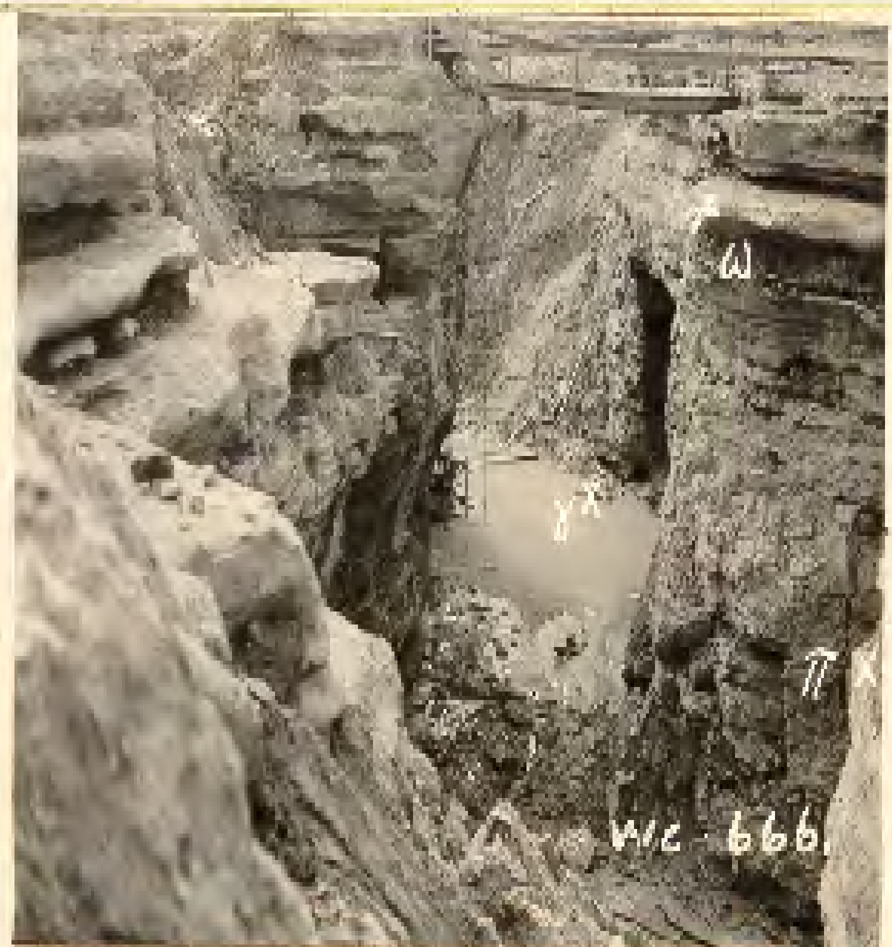
I-E

will be removed only where they cross the line of the trench, since the earthfill in the sides of the trench will have the function only of stability and not of an absolutely uniform tight contact with the trench walls. Tamping will supplement the regular rolling of the fill as required under the overhangs and irregular salients.

8-22-42/Looking S in trench from vicinity embankment sta. 36+10.

I-G

I-G. Note rock channel between points ω and π, with abrupt ledge floor at level of π. This floor was underlain by solution weathered rock and was not continuous (see photo I-H). Above the floor, the walls were extremely irregular, with overhanging ledges. These were knocked off and weathered rock removed to condition shown in photo I-F.



9-21-42/Looking S in trench from vicinity embankment sta. 36+10.

I-F

I-F. Note final condition of rock channel between points ω and π (see photo I-G). This channel is along line M of Exhibit 3. Note tapering continuation of the channel across intersecting channel.

Before

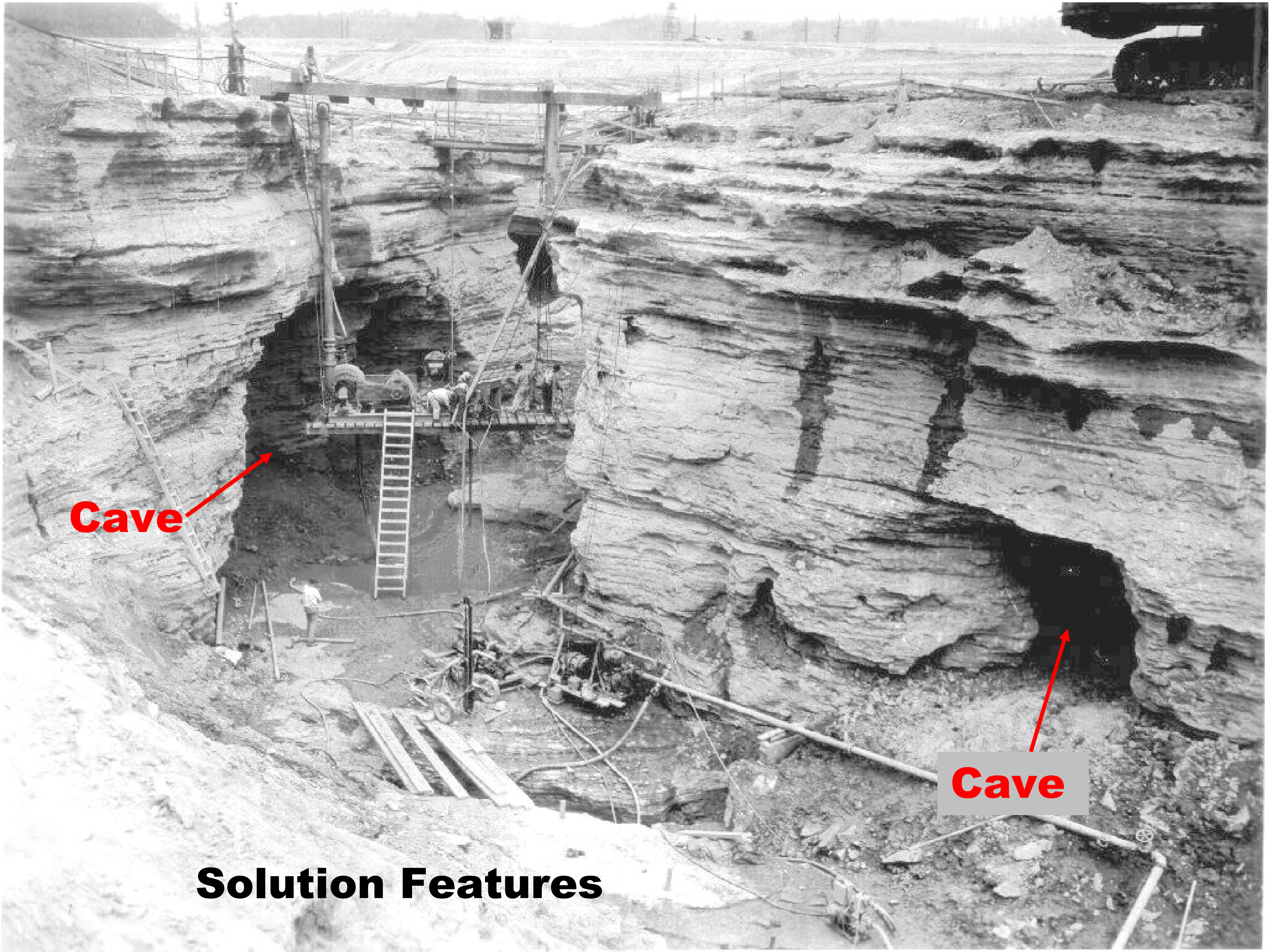
After

-2-42.Looking SE along
hole at trench sta.27+95. IV-A

4-2-42.Looking S across
hole at trench sta.27+95. IV-B

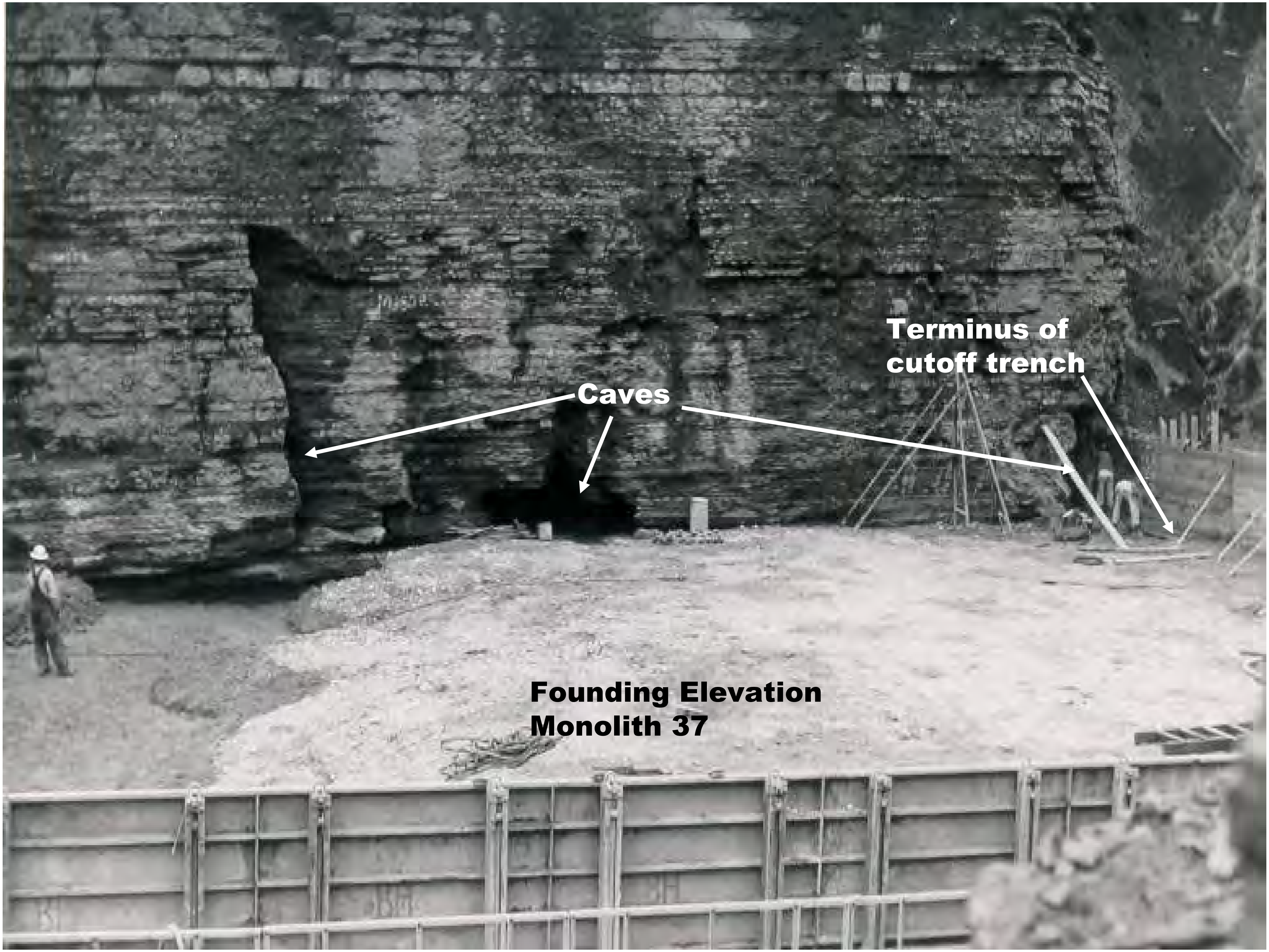
IV-A and -B. The hole is a solution widened joint, crossing the trench at right angles. Note differential solution and resulting overhangs in rock faces. These re-entrants were apparently well filled with silt.

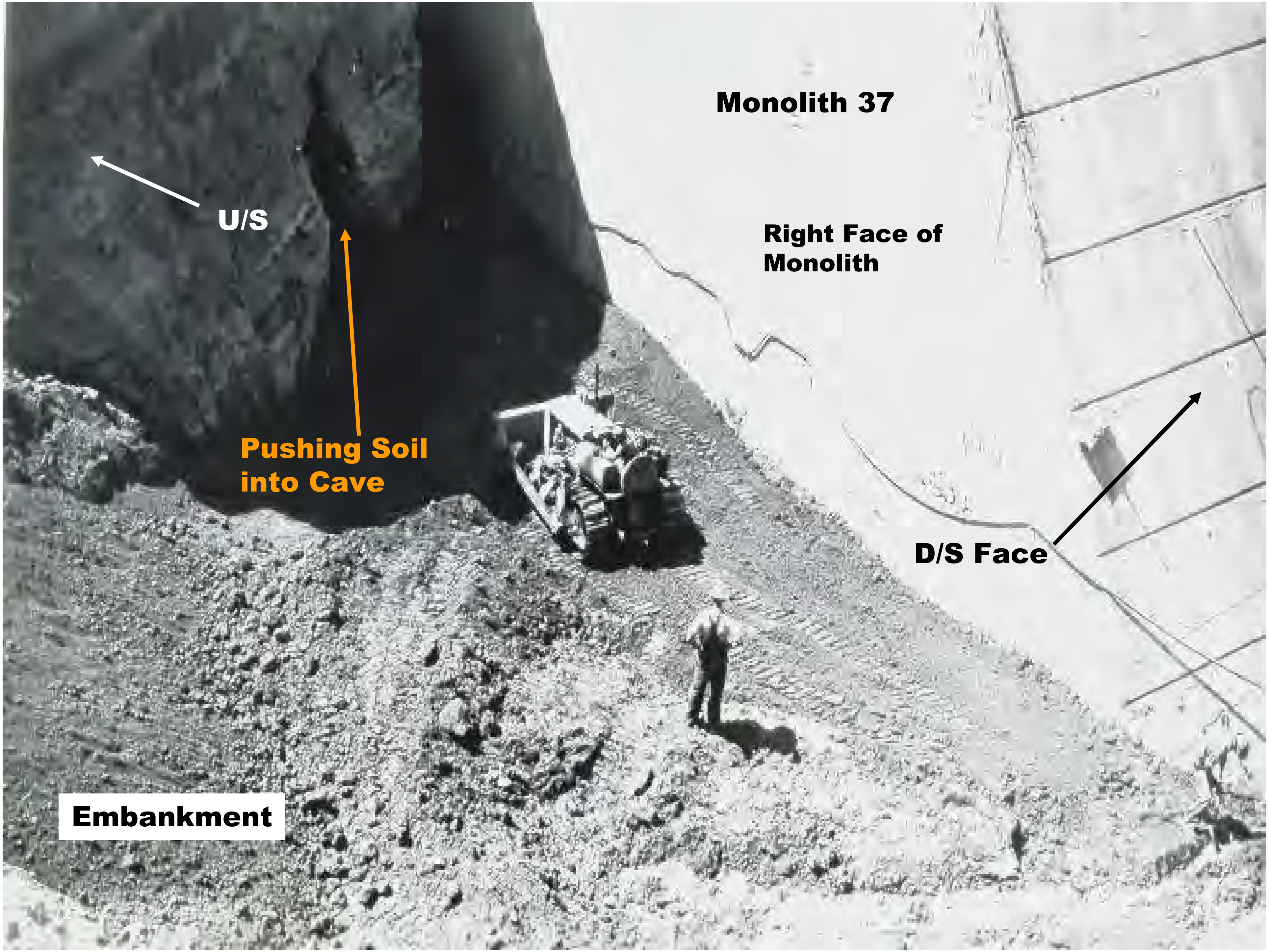
31,822 19 November 1942
View of backfilling operations in cavity at Sta. 50+00 on cutoff trench


Cave
Cave
Solution Features

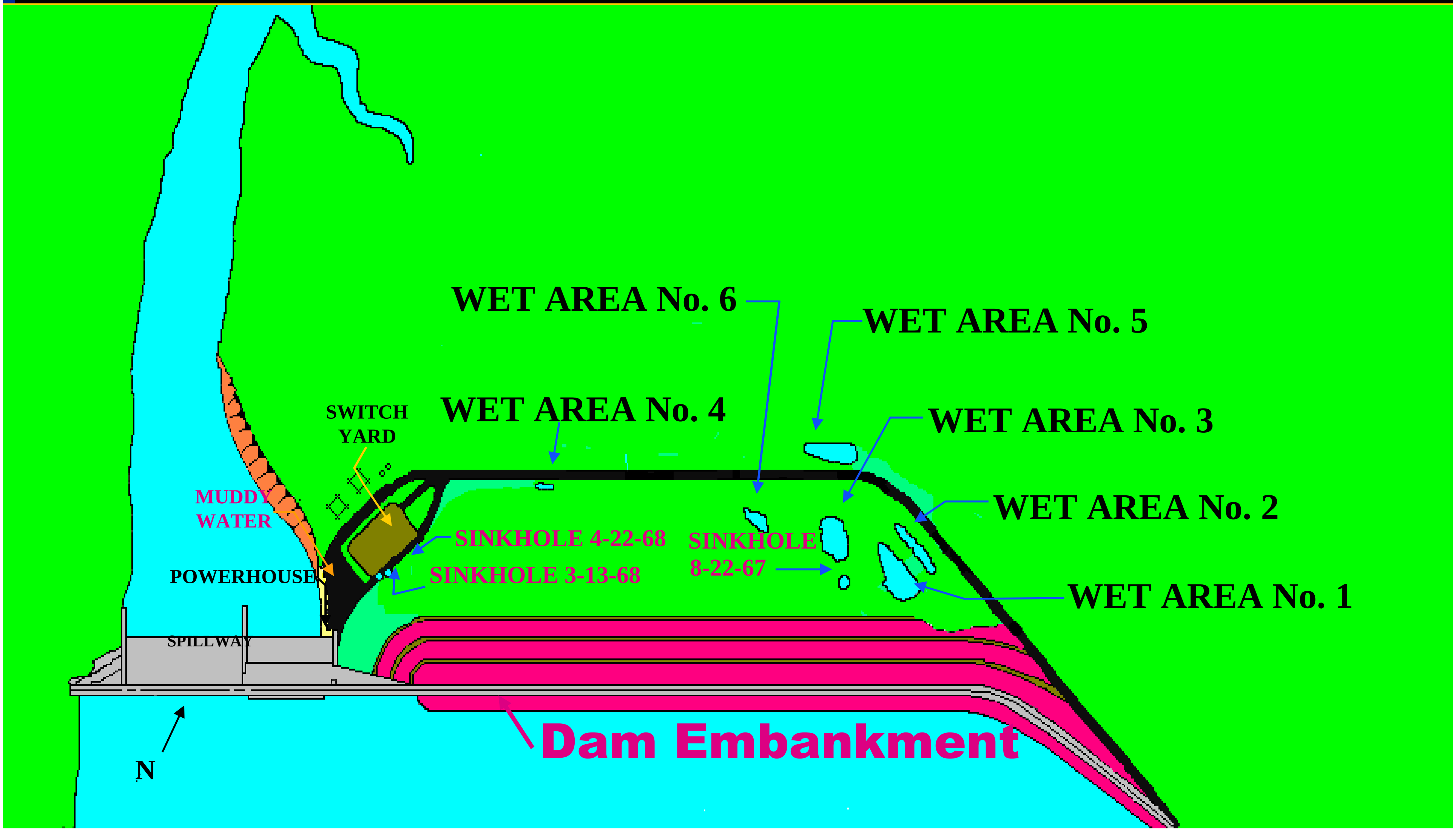

Looking from monolith 36 into cutoff trench where it ties into monolith 37
Cave
End Monolith (37)

61/421 14 August 1947
Filling core trench, Mon. 37

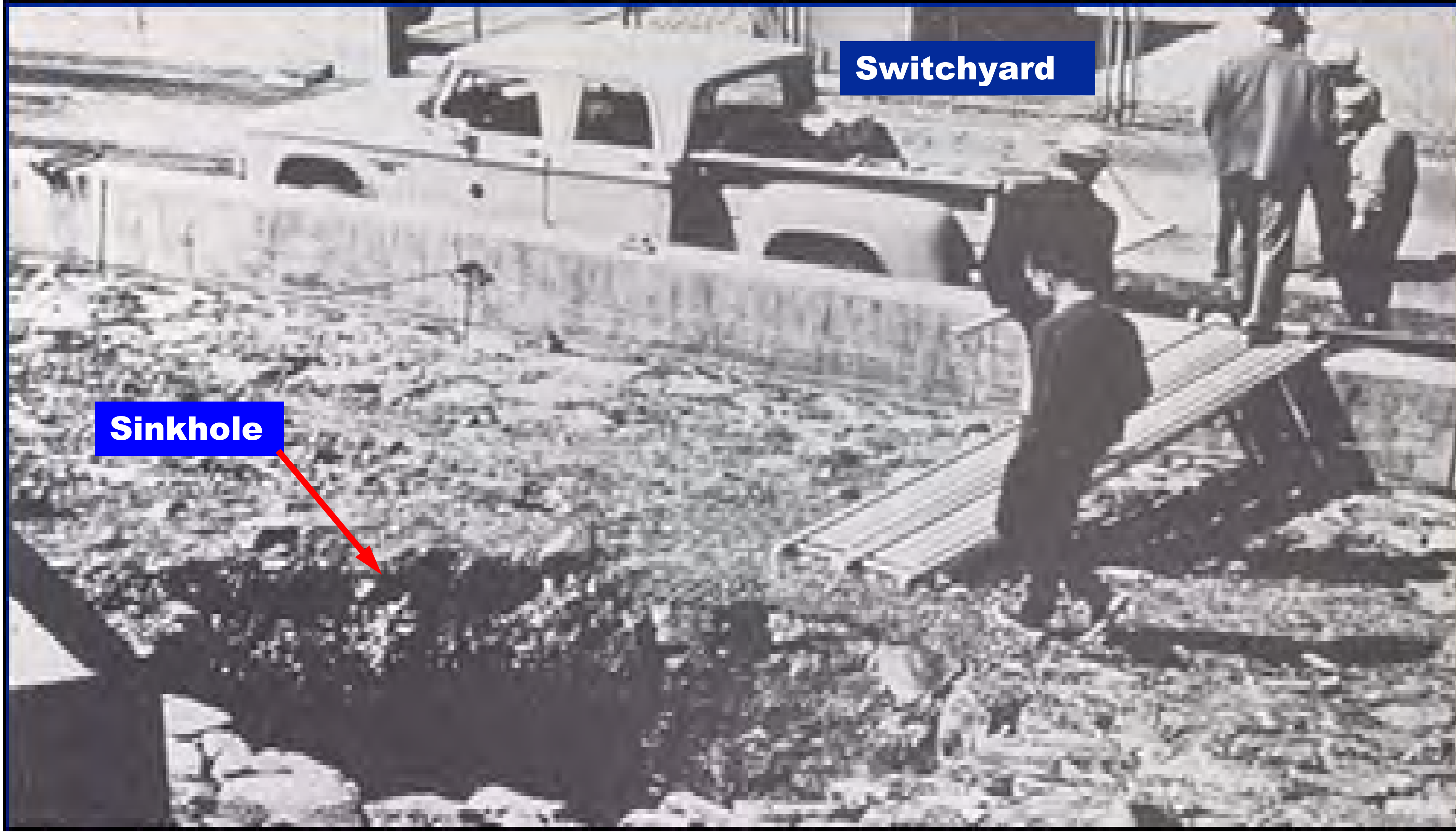

Terminus of
cutoff trench
Caves
Founding Elevation
Monolith 37


Monolith 37
U/S
Right Face of
Monolith
Pushing Soil
into Cave
D/S Face
Embankment

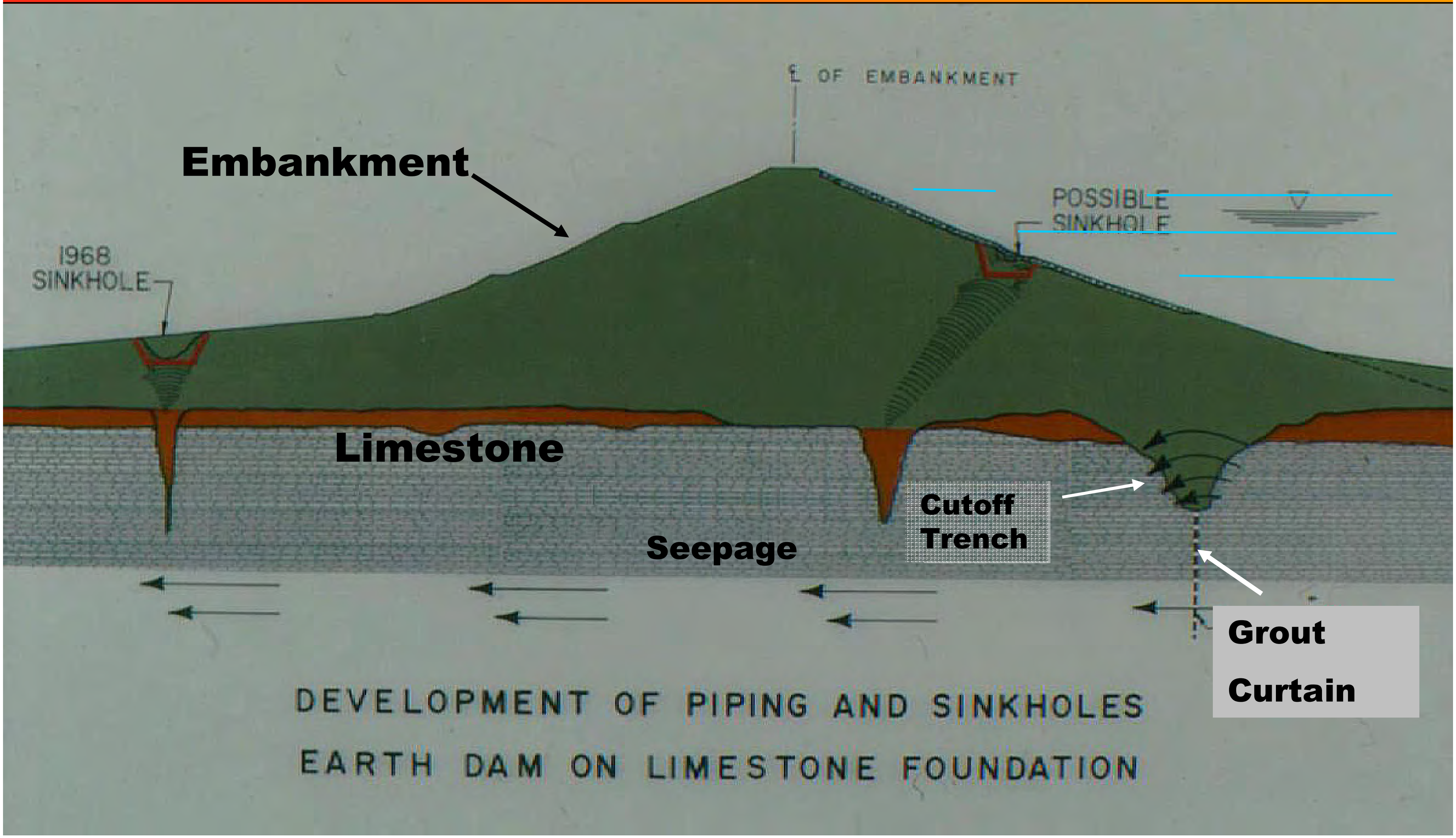
Initial Distress Indicators 1960's



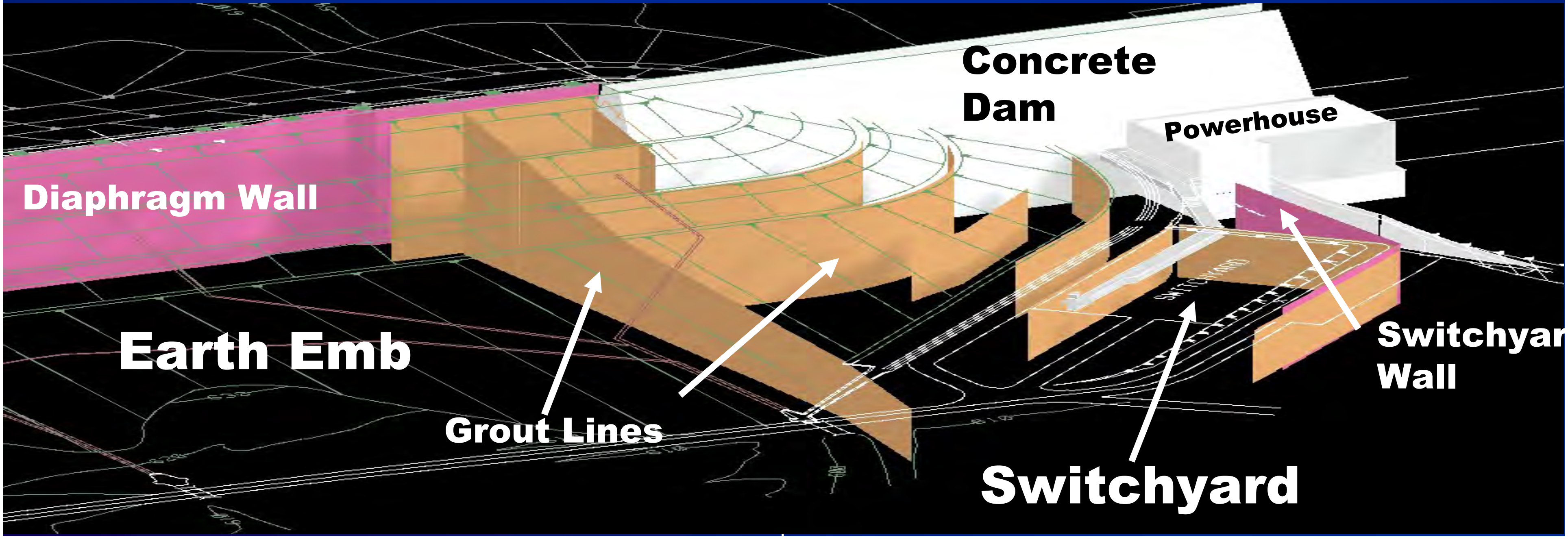
1968 Sinkhole



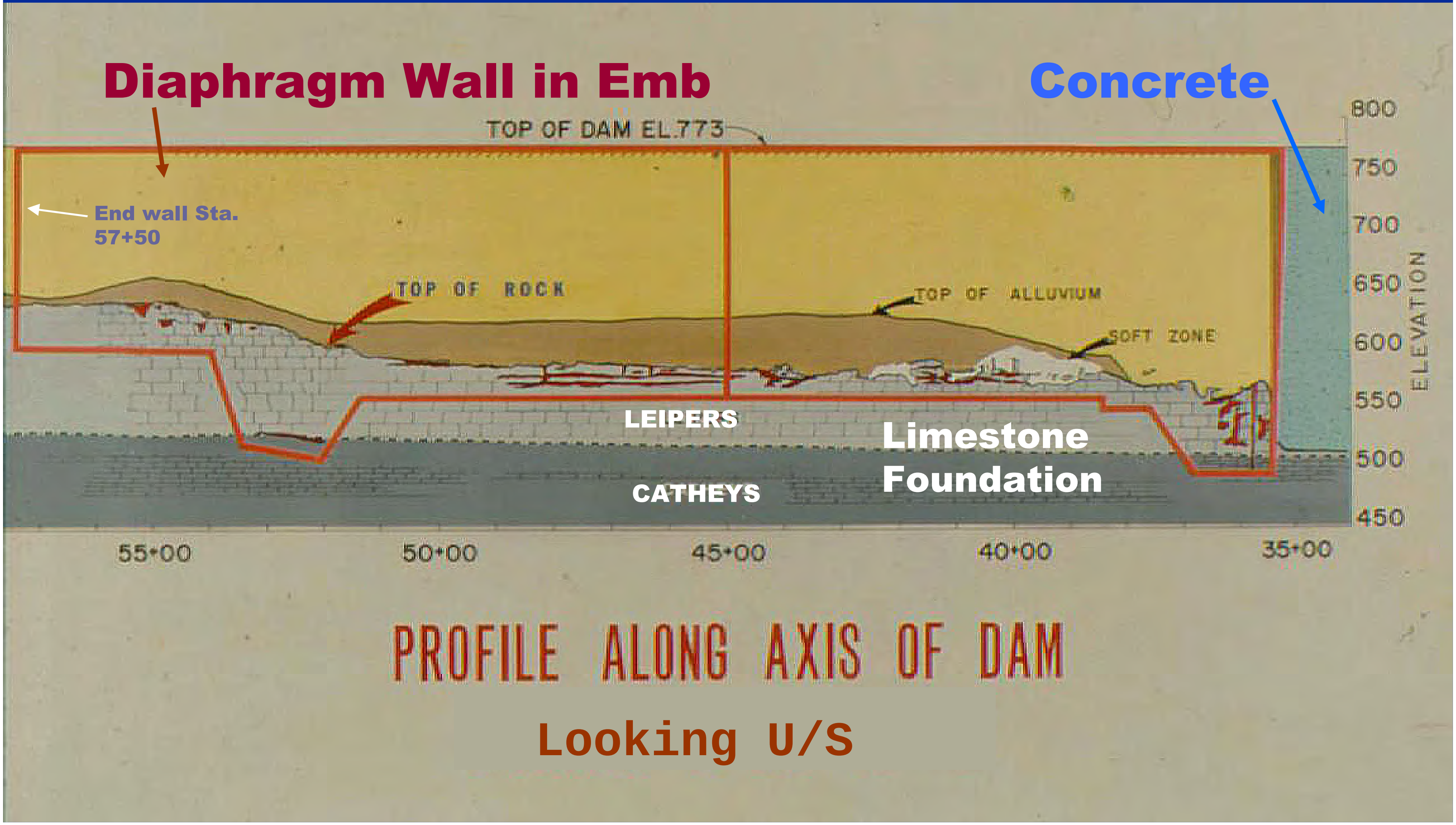
Piping and Sinkhole Development



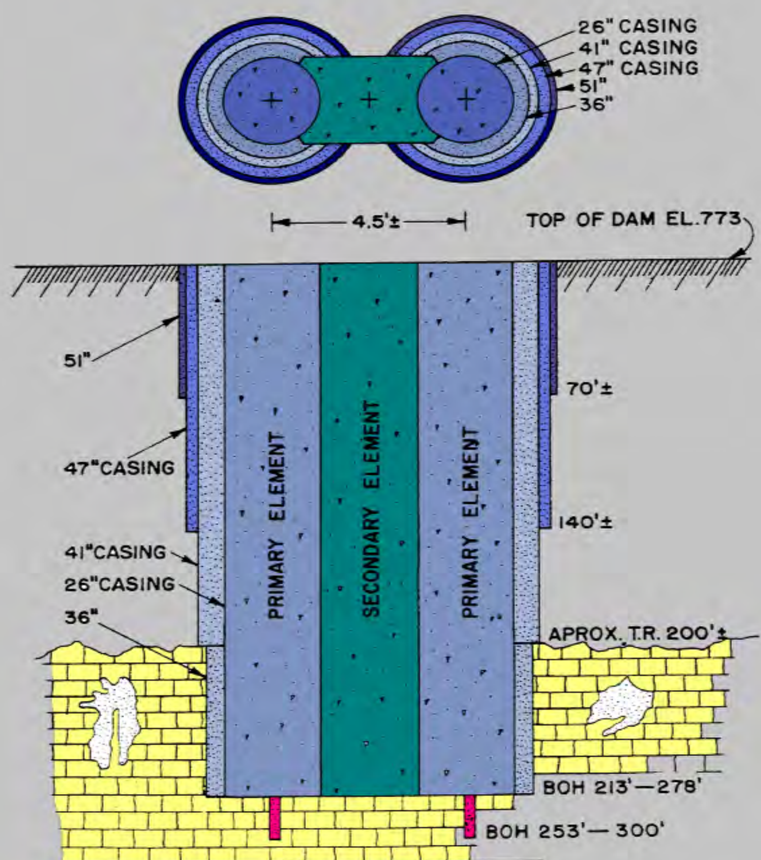
1960's and 70's Remedial Features



Profile along Diaphragm Wall



Diaphragm Wall

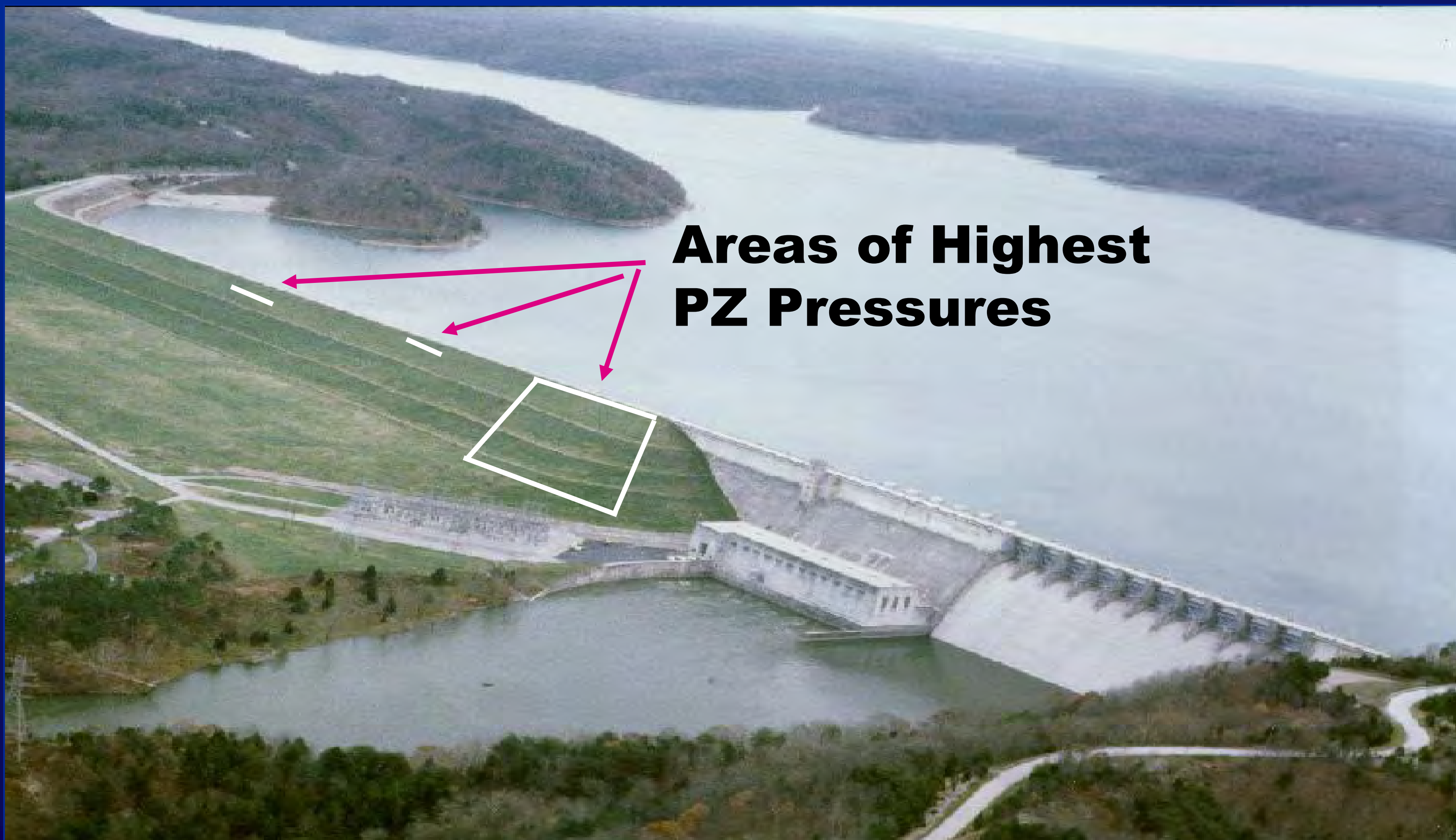


Typical Section

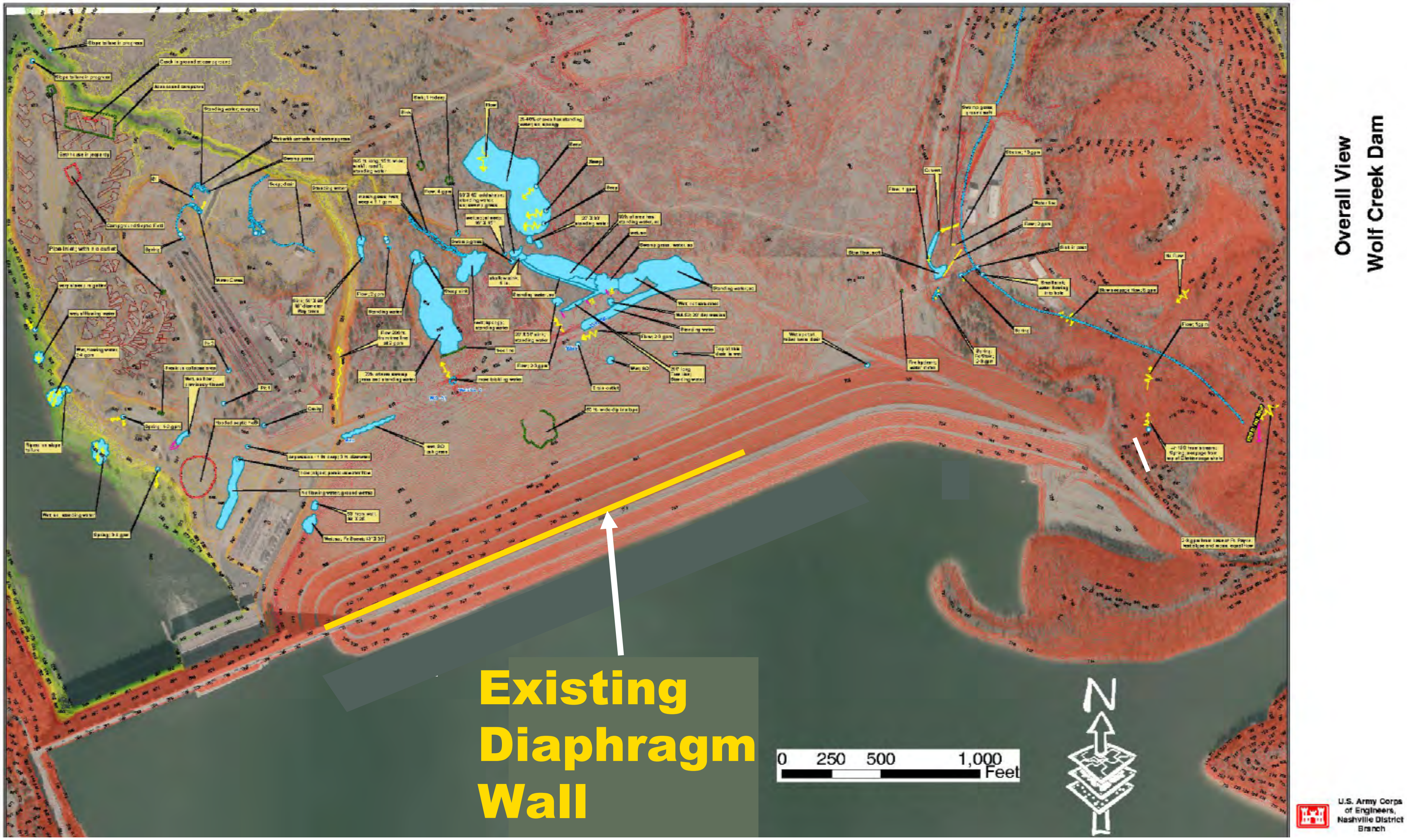
Post Wall Performance/Current Distress Indicators

- Piezometers
- Wet Areas
- Settlement
- Soft Zones
- Temperature Survey
- Other

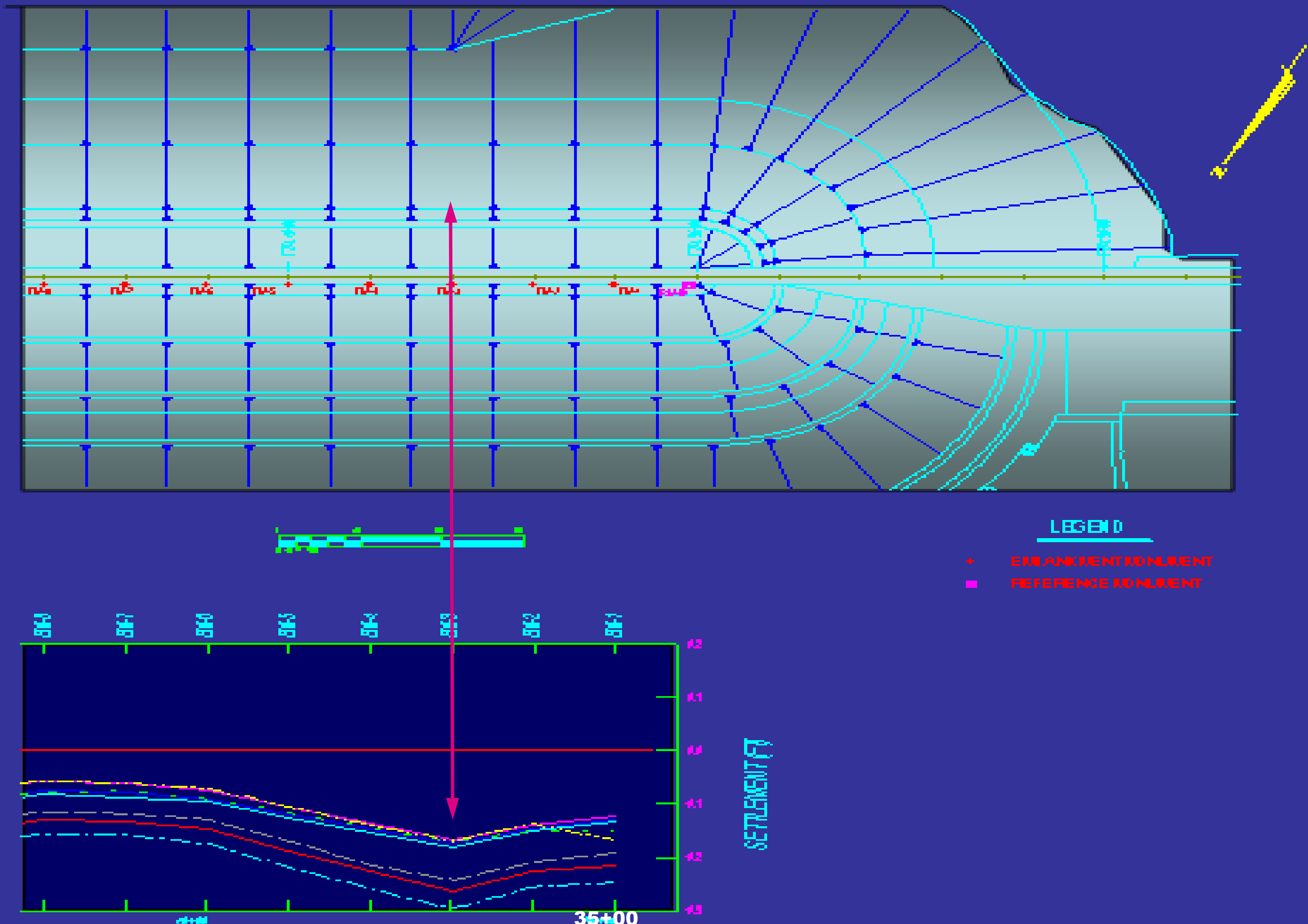
High PZ Pressures



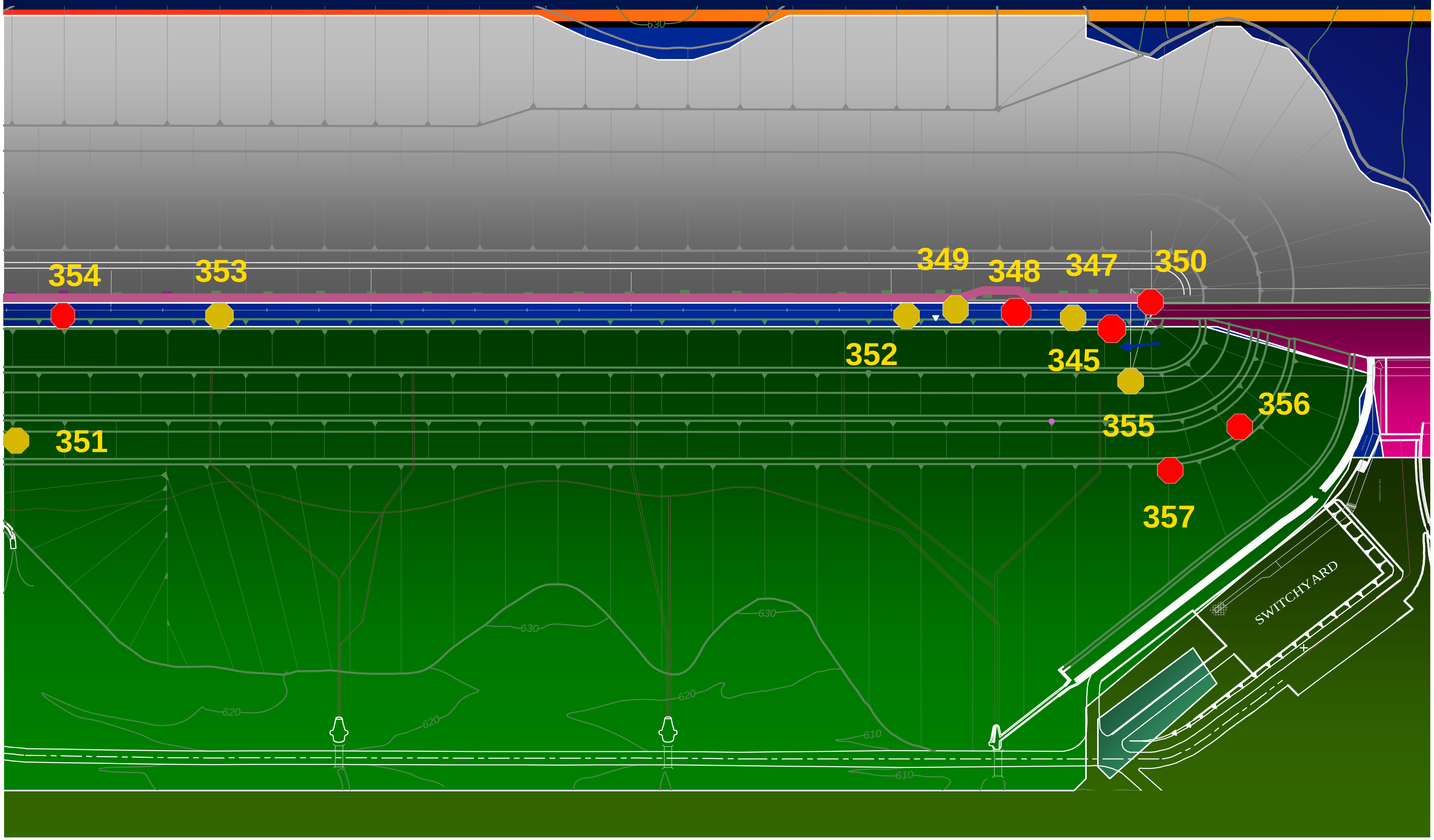
Post Wall Performance – Wet Areas



Post Wall Performance - Settlement



2002-2003 Resonant Sonic Investigations



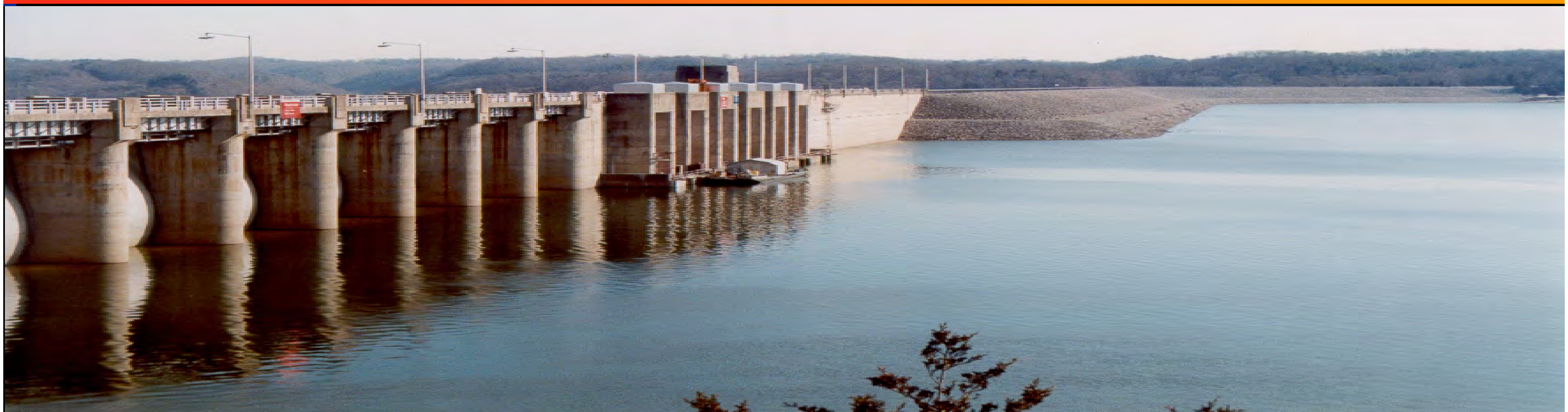
Other Concerns/Distress Indicators

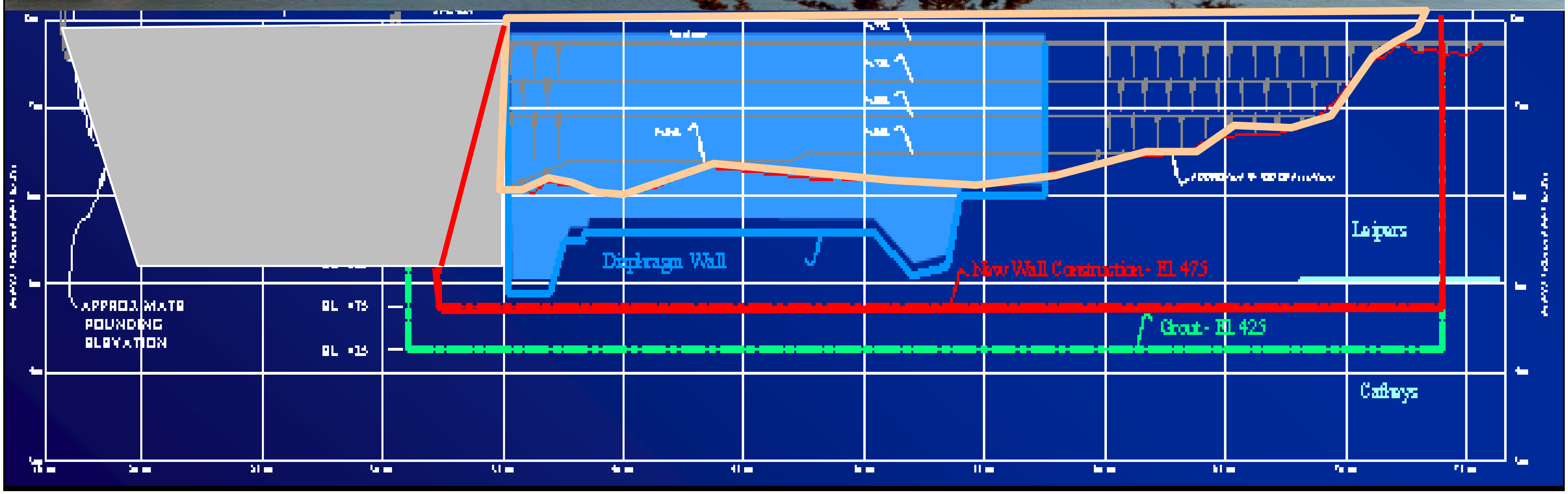
- Cool Spots from Piezometer Temp. Survey
- Cable Tunnel Seepage and Cracking
- Increased Seepage and Instability Problems in the D/S Riverbank
- Structural Integrity of Existing Wall

Reasons for Continuing Distress

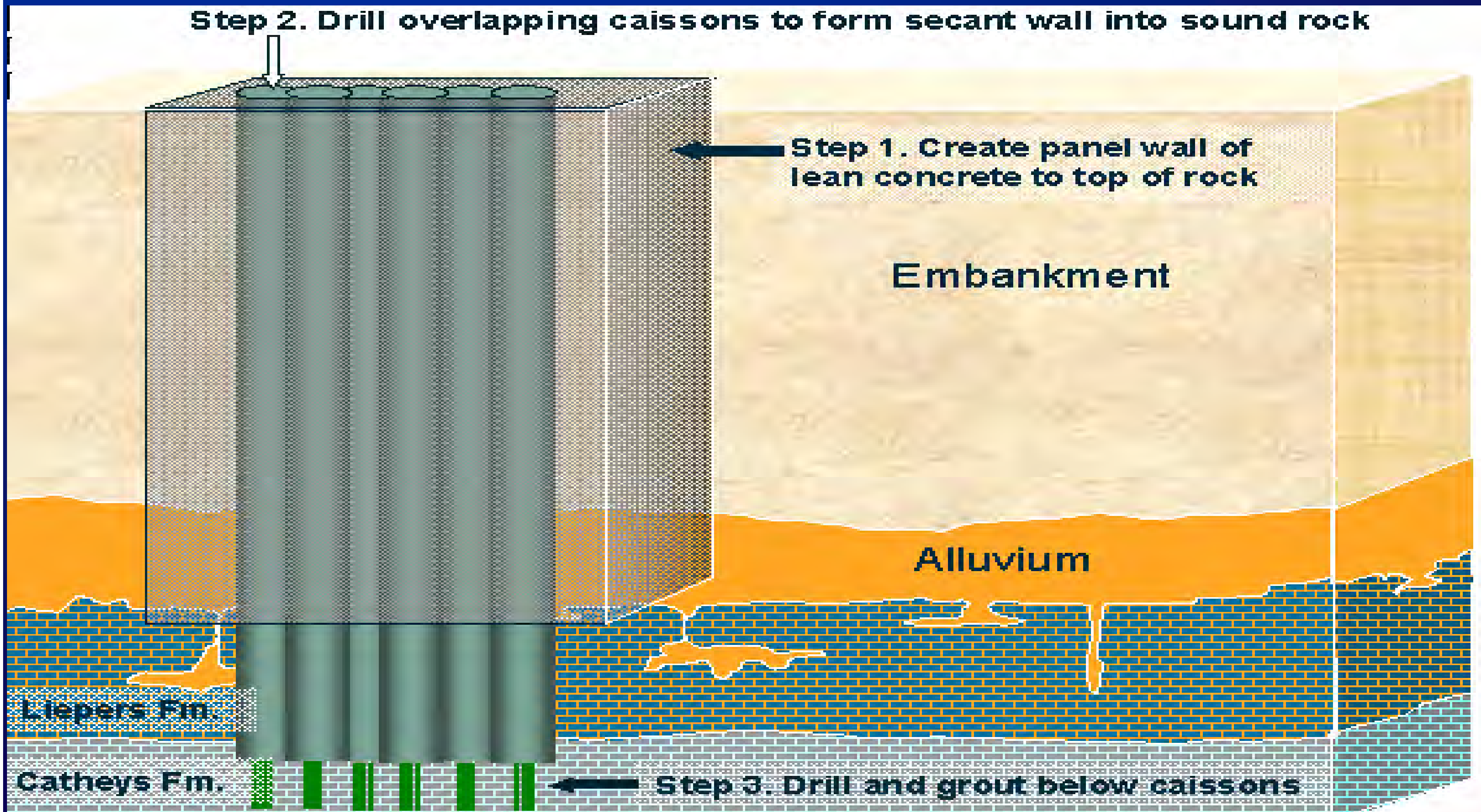
- Seepage coming around ends of wall
  - Through features untreated beneath monoliths
  - Around right end where no wall exists
- Below wall through features untreated or partially treated by previous grouting
- Through defects in wall itself

Proposed Remedy

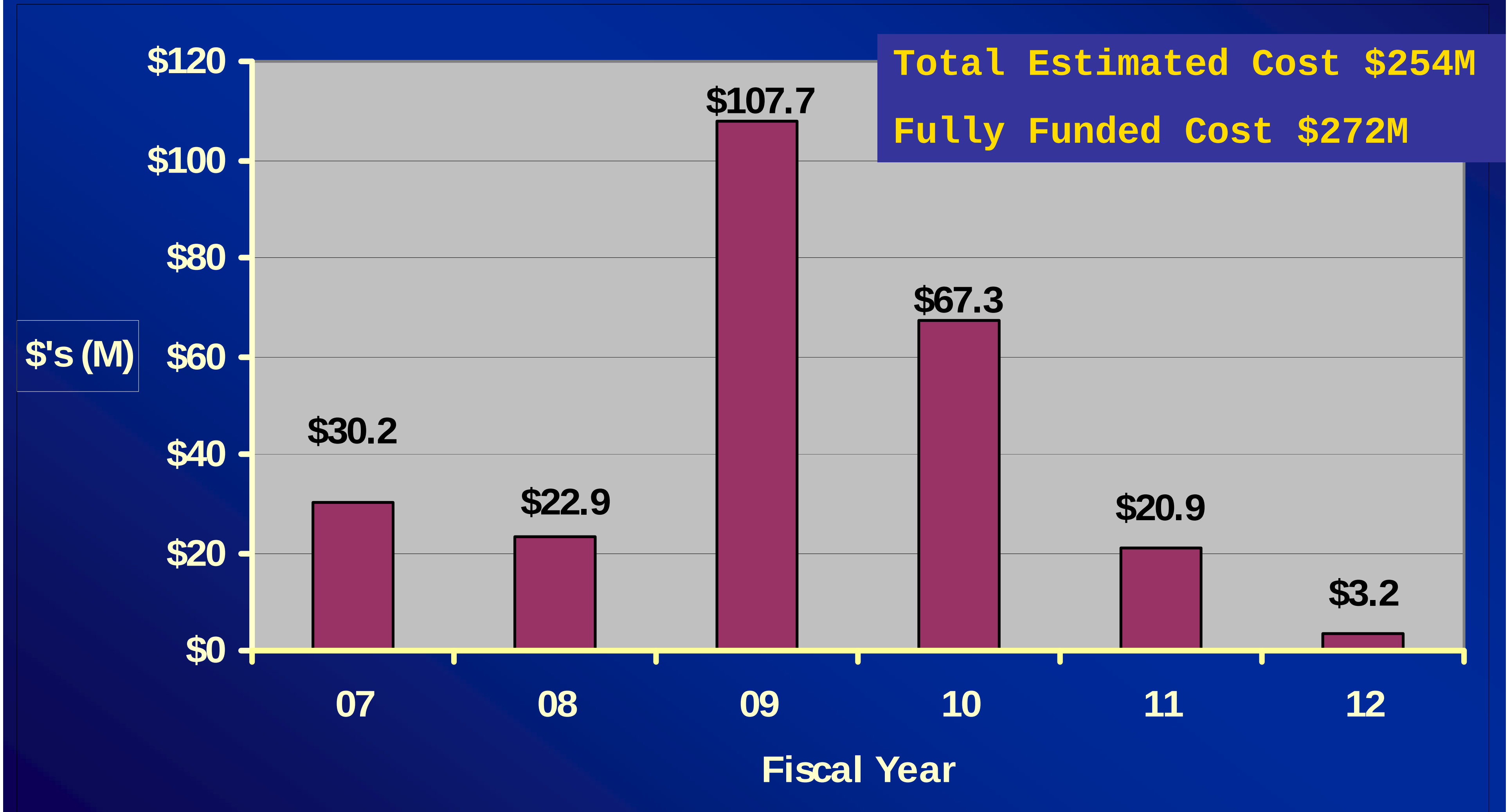




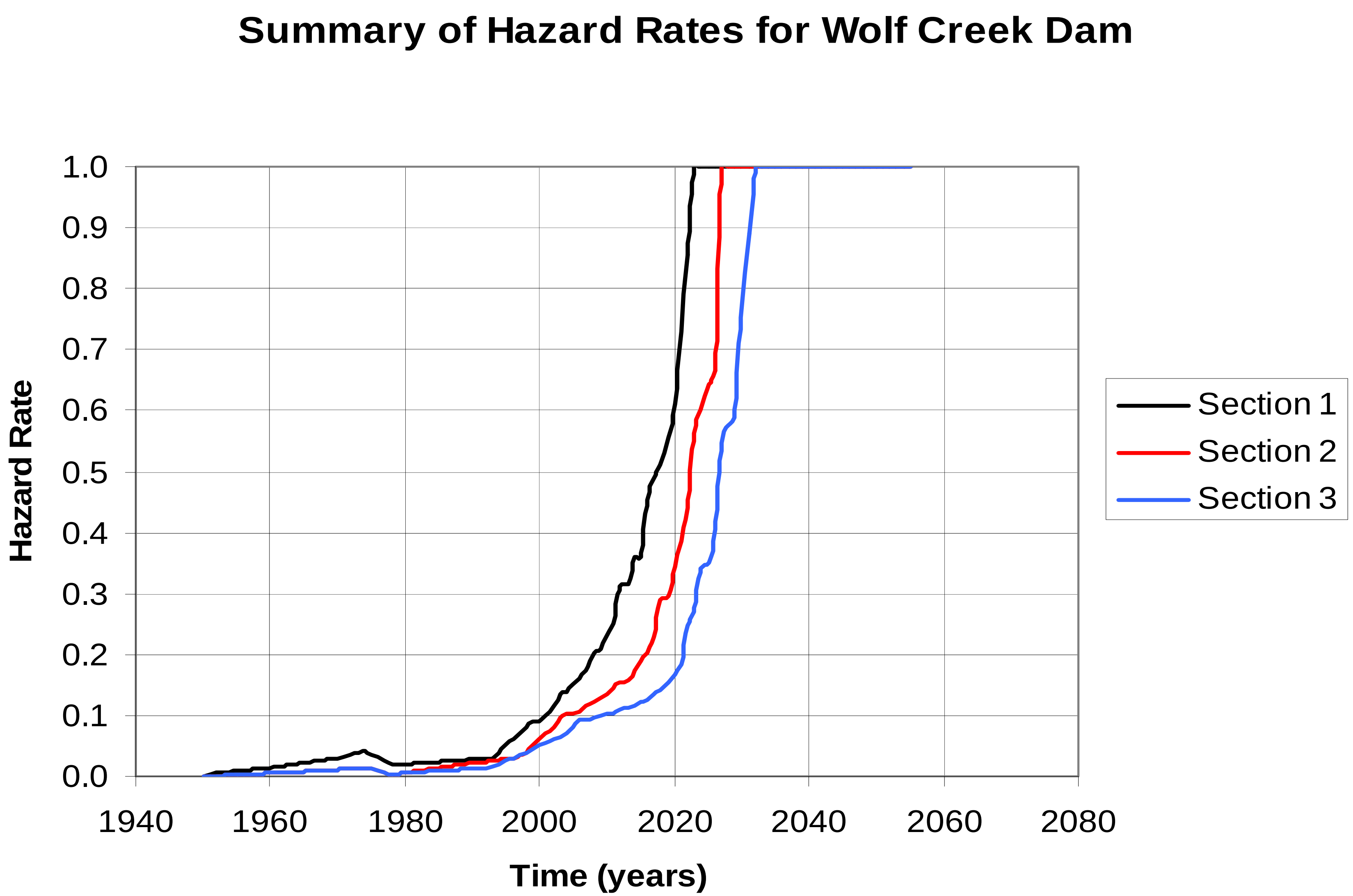
Proposed Secant Wall



Unconstrained Construction Cost By FY



Reliability Analysis
Hazard Rates



Questions?

Speaker Info. Slide

- Michael F. Zoccola P.E.
- Nashville District Corps of Engineers
- 615-736-5693
- michael.f.zoccola@lrn02.usace.army.mil